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VETERINARY MEDICINE

NOVEMBER CONTENTS 1948

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VOL. XLIII
No. 11

Entered as second-class matter Nov. 8, 1920, at the post office at Chicago, Ill., under the Act of March 3, 1879.

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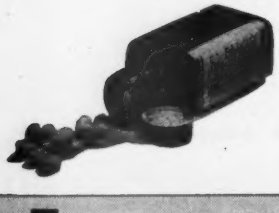

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VETERINARY MEDICINE

Registered in U. S. Patent Office

VOL. XLIII NOVEMBER, 1948 No. 11

Published Monthly by the

VETERINARY MAGAZINE CORPORATION

7632 S. CRANDON AVE., CHICAGO 49, ILL., U.S.A.

$5.00 a year; per copy 50 cents

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Entered as second-class matter Nov. 8, 1920, at the post office at Chicago, Ill., under the Act of March 3, 1879. Entered as second-class matter under the title of American Journal of Veterinary Medicine July 19, 1910, at Chicago, Ill., under the Act of March 3, 1879.

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Pasture is the basis of beef production and good grazing is the basis of economical beef production.

Posterior pituitrin does not seem to be as effective in aiding in the expulsion of retained fetal membranes—possibly because of its tendency to contract the cervix uteri—as is diethylstilbestrol, which is the agent of choice.

The implantation of one 50mg-tablet of stilbestrol in the udders of virgin ewes induced satisfactory lactation in nine to 15 days. Implantation of larger doses and implantation in the neck was less satisfactory. Although the implant was made in the right side of the udder in all cases, the milk production of the two halves was uniform.

In Canada it is unlawful to sell or offer for sale, for consumption as food, poultry to which any preparation having estrogenic activity has been administered. The sale of any preparation having estrogenic activity for administration to poultry, that may be consumed as food, is also forbidden by authority of the Food and Drug Acts.

At the meeting of the Society of American Bacteriologists in Minneapolis, May 12th, Dr. C. A. Brandley, University of Wisconsin reported the development of a fox distemper bcterin that affords adequate protection of the animals during the period they are on the furring range. It consists of killed virus, but engenders a longer lasting immunity than other killed virus preparations.

In Sweden reactors to the brucellosis test are isolated until they calve or abort. At that time a bacteriological examination of the fetal membranes is made. If Brucella organisms are found the animal is destroyed.

Of a considerable number of bison and elk collected for slaughter because of over crowding in national parks in Alberta, all elk were negative to a test for brucellosis, but 13% of the bison gave positive reactions.

The only rational course to pursue in the eradication of bovine brucellosis is wholesale vaccination. Experience has shown this will reduce the number of infected animals to a point where the extirpation of them will cause neither financial nor production hardship.

More than eight million pigs have been vaccinated against swine erysipelas under official supervision in the past 10 years; using the live-culture-antiserum method. Had an equal effort been made to vaccinate calves against brucellosis, the eradication of that disease would be much further along than it is at present.

Professor Valentin German of the Kharkow Veterinary Institute, claims to have solved the problem of blood transfusion to animals. He has established the existence of four basic blood groups for horses and elaborated a new method of blood transfusion. Two hundred successful blood transfusions have been made. —*Horse and Pony News* (England).

New Veterinary Dean at Texas A & M

Professional Veterinary education, veterinary research and veterinary extension have been integrated at the Texas A & M college into a single unit. Dr. I B. Boughton from the Agricultural Experiment Substation at Sonora, Texas, has been appointed dean of the combined services.

Doctor Boughton was graduated from the College of Veterinary Medicine, Ohio State University in 1916. He taught at the University, 1919 to 1925. He served for a period on the experiment station staff of Haiti before taking up research in Texas in 1932.

Dr. R. C. Dunn, interim dean of the School of Veterinary Medicine, will continue as head of the Department of Veterinary Pathology and Bacteriology, a position he has held for a number of years. Dr. Hubert Schmidt, chief of the Division of Veterinary Science in the Agricultural Experiment Station will head the new veterinary experiment station staff.

First International B.C.G. Congress

An international congress, the first on B.C.G. (Bacillus Calmette Guerin), was held at the Pasteur Institute in Paris during July, 1948. Although this congress dealt almost exclusively with human tuberculosis, the proceedings possess a great deal of interest for veterinarians. (1) The president of the congress was Dr. Camille Guerin, a distinguished veterinarian. (2) It was Doctor Guerin, who with Calmette, his predecessor as director of the Pasteur Institute, developed the non-pathogenic strain of *Mycobacterium tuberculosis*, which constitutes the vaccine. Guerin's part in the development is commemorated by the "G" in its name. (3) B.C.G. ranks along with the control or eradication of tuberculosis in cattle, as contribution from the veterinary profession to the control and elimination of the disease in man.

More than 100 papers were read before the four sections of the congress. The consensus of the congress on these subjects is epitomized in the resolutions appended.

The third section of the congress dealt with the veterinary use of B.C.G.; the conclusion being that its use in Italy by Professor Ascoli and elsewhere by others has demonstrated conclusively that B.C.G. vaccination of cattle largely reduces the extension of the disease in this animal. This is illustrated by the typical result in a large, commercial dairy in Italy. When the use of B.C.G. was commenced 90% of the cows in the herd were positive reactors to the tuberculin test. All calves to be retained in the herd were vaccinated with B.C.G. and segregated for 90 days. At the end of eight years all of the original reacting cows had been eliminated, for economic reasons. The herd had been maintained at approximately the same size solely by retention of vaccinated calves. Only 10% were tuberculin reactors.

Among others, the congress passed, unanimously, the following resolutions as given by the *J. Am. Med. Assn.*: that over ten million vaccinations practiced in the whole world for 25 years confirm the absolute innocuity of B.C.G. vaccination in human beings; that B.C.G. vaccination constitutes the most effective means of preventing tuberculosis; that the vaccine B.C.G. strain used in all countries originates from the Paris Pasteur Institute; that the technic confirmed by tests in Paris at the Pasteur Institute insures its vitality; that the congress recommends the introduction of the vaccine through the skin, the modes of application of which are varied; that the congress does not exclude the oral administration for practical reasons; that the congress recommends the vaccination of subjects whose cutaneous sensitivity to tuberculin has disappeared; that the congress considers urgent as widespread a diffusion as possible of the B.C.G. vaccination; that the congress recommends the development of all other prophylactic measures employed in the fight against tuberculosis.

Army Veterinary Officer Elected to the Order of Vasco Nunez de Balboa of Panama

Colonel Donald S. Stevenson, Veterinary Corps, United States Army, detailed to duty as veterinary advisor to the Minister of Foreign Affairs of the Republic of Panama, was elected to the Order of Vasco Nunez de Balboa of Panama, April 26, 1948. The national decoration, in the grade of Commendador, was conferred upon Colonel Stevenson by Mr. Guillermo Mendez P., the Panamanian Minister of Agriculture, Commerce and Industries, and acting chancellor of the Order, in a ceremony held in the Office of Foreign Relations.

Colonel Stevenson was first detailed to Panama in December 1946 at the time that an unusually severe epizootic of equine encephalomyelitis was reported in horses in the central provinces. The epizootic was soon moderated by effective, modern means of preventive veterinary medicine. Since then, Colonel Stevenson has played an important role in formulating, advising, and assisting in the development and operation of a well-rounded veterinary program related to a veterinary educational sys-

tem, animal and livestock industries, and the public health services of the Republic of Panama. The recognition of the services of Colonel Stevenson reflects on the success of the United States Military Mission to Panama.

When the synthetic drug histadyl is given with other drugs such as penicillin and streptomycin, it is said to prevent allergic reactions from these drugs.

Avian pneumoencephalitis has been demonstrated by laboratory diagnosis to be present in 43 states, and has been diagnosed clinically in four of the five remaining states.

"Sales to Veterinarians Only"

The motive of firms and individuals, who sell biological products, sulfa drugs and other potent medicines for internal or parenteral use in animals, by the owner, is often questioned. It is contended they are indifferent to the fate of the animals, the financial well-being of the owner or the food supply of the nation and concerned only with making a profit for themselves.

A radio broadcast recently by Everett Mitchell on "Town and Farm" lends support to this view. Certainly if it served the livestock owner best to be his own quack, the great packers with their intimate contact with all parts of the livestock industry would know it. A typical question and answer in this broadcast interview follow:

Mr. Mitchell: "You mention the fact that you sell only to graduate veterinarians. What is your idea in handling your products in this manner?"

Mr. Cook (head of the laboratory division of Armour and Company): "Simply this. Armour purchases for its many packing plants a large percentage of all meat animals produced in the United States. Naturally, it is important that these animals reach our plants in the best possible condition. Years of experience have demonstrated to us that the graduate veterinarian is the one person qualified by education and experience to diagnose the ailments of livestock and to prescribe treatment. For this reason we think we can best serve the livestock raiser and our own company by offering our products only to the veterinarian."

No one could have the hardihood to question the interest of a meat packer, and least of all one of the "big four", in the healthfulness of livestock and prosperity of the livestock industry. "Long years of experience" have convinced them that the owner of an ailing animal, or herd, is served best by supplying the medicaments he needs only to those trained to use them. Those who do otherwise lay themselves wide open to the charge of sabotaging one of the important industries of the nation.

The goal of the antivivisectionist is not the prevention of suffering, but the knowledge of how to relieve suffering.

Resolution Supporting Continuation of Scientific Research

The following resolution on animal experimentation was unanimously passed by the Executive Committee of the American Association for the Advancement of Science at its centennial meeting in Washington, D.C., September 15, 1948.

At this Centennial Meeting the American Association for the Advancement of Science reaffirms its conviction that animal experimentation is essential for progress in the biological and medical sciences.

We recognize the important role of animal experimentation in the study of and the control of diseases, especially those of childhood, and in the perfecting of those procedures and treatments to which no small part of our community owes its health and life.

We regard with apprehension the activities of certain groups which are attempting to prevent the use of unclaimed animals for study in qualified institutions of biology and medicine.

This association is in accord with the practically unanimous and often expressed authoritative voice of science and medicine that animal experimentation has conferred and is conferring inestimable benefits upon mankind, as well as upon animals themselves.

The American Association for the Advancement of Science, with a membership of over forty thousand and representing all the sciences of nature and of man, is confident that a fully informed public will not support legislation which would seriously interfere with the progress of preventive and curative medicine.

The Association believes that a supply of animals for research and teaching purposes for qualified institutions should be assured, by legislation or ordinance where necessary, and not left to the option of local pound officials and private groups.

Facts About Benzene Hexachloride

1. Benzene hexachloride is a greyish-white, musty-smelling, irritant powder.

2. A single application (by spraying or dipping) will cure mange in hogs. The application must be thorough, wetting the entire surface of the animal and the inside of the ears.

3. In inclement weather the powder may be dusted on the animals. The one doing the dusting should wear a surgeon's mask and goggles and protect the eyes of the swine. Mix the benzene hexachloride powder with nine times its volume of fuller's earth, talc or other inert powder.

4. Two applications of benzene hexachloride, 10 days apart, will rid a drove of lice.

5. The gamma isomer is the portion of the chemical that gives it its effectiveness. The crude mixture should contain 5% of the gam-

ma isomer. Benzene hexachloride costs about $1.00 a pound or less. Sufficient to treat a weanling pig costs about two cents.

6. The odor of benzene hexachloride will remain on animals for two or three days and in nests inside hog-houses for as many weeks.

At the moment, phenosulfazole qualifies as the newest among the useful sulfa drugs. And it is more than the newest, for it is the first to give promise of successfully combatting viruses. Probably not all viruses but maybe some important ones, *e.g*, polio and rabies viruses.

A New Antibiotic Agent

Penicillin, the miracle antibiotic agent, its predecessor, tyrothricin, and its follower, streptomycin, have a common failing—wonderful as they are, they are toxic only to bacteria. Protozoa, rickettsias and viruses are immune to their effects. Aureomycin, the newest mold-produced antibiotic substance, appears to have breeched this heretofore invulnerable front and invaded the field of rickettsial diseases. Rocky Mountain spotted fever, typhus and "Q" fever organisms appear to be inhibited by it. It also promises success against the viruses of Lymphogranuloma venerum and psittacosis.

Veterinary Use of Antihistamines

Although the use of antihistamines in human medicine has mushroomed enormously they have been but sparingly employed in veterinary medicine, probably in the first place because animals suffer but little from known allergies, as compared with man, and for the further reason that the cost is high for use of these agents on large animals.

Naturally, the use of an antihistamine in veterinary medicine was first described in VETERINARY MEDICINE (Histamine Theory and Treatment of Laminitis by Jean Chavance, *Vet. Med.* 41:6, pp. 199-201, June, 1946). So far as the the antihistaminic treatment of laminitis has been employed in this country, the results have been gratifying, lending support to the French theory that the disease is an allergy. The evidence that periodic ophthalmia also is an allergy is about as weighty as is the evidence that it is anything else. When the subject is explored it may be found that a number of the ailments of farm animals are histamine engendered. This is almost certainly so of cattle and sheep. In any case, all farm animals are subject to plant poisoning and if antihistaminic agents will relieve a number of such poisonings it should be known. Experimentally, allergies have been shown to delay the healing of wounds in rabbits.

Diaz-Rivera, Deliz and Berio-Suarez, three Puerto Rican physicians, report (*J. Am. Med. Assn.*) a reduction in the mortality from tetanus from the addition of penicillin to the usual treatment. The mortality among negroes was 30% and among whites 15% in the Puerto Rican cases reported.

Alexander and Landwehr report (*J. Am. Med. Assn.*) the relief of hemophilia over long periods by blood and blood plasma transfusions, three to four times weekly. Distressing anaphylactic reactions occurred in about 1% of the transfusions. The condition recurs promptly when the transfusions are discontinued.

Diphtheria toxoid and whooping cough vaccine are more effective in children when given together than when given independently. This raises a question as to the soundness of the opinion quite generally held by veterinarians that a more solid immunity in animals results from giving one prophylactic agent at a time.

Carotene—also known as pro-vitamin A or the precursor of vitamin A—is the basic substance from which vitamin A is derived. Originally obtained from the carrot—hence its name—it is now extracted from many vegetable sources. It is unquestionably one of the important nutritional vitamins. A deficiency of vitamin A in the ration is held to be responsible for night blindnes, hyperkeratosis, xeropthalmia and other ailments. However, an excess of carotene, as exemplified by promiscuous fortifying of all foods with it, is not recommended.

New Antidotes for Poisons

The antihistamine preparations have multiplied like the antibiotic agents. Starting with antergan and later neo-antergan of the French, we have seen developed in this country benzadryl, pyribenzamine, thenylene, antistine, thephorin, nepera, rhone poulenc, etc. All are derived from one basic substance and all spectacularly relieve hives and some other forms of itching. They differ in capacity to relieve hay fever and allergies due to other than pollens, but all relieve at least some of such cases.

Dr. Daniel Bovet, a French scientist who discovered antergan, the first antihistaminic agent, while pharmacologist at the Pasteur Institute, now suggests that these agents are effective antidotes of certain poisons, including curare and some purgatives, which he reports appear to act in the body by releasing histamines.

Penicillin Dust Effective

Research workers at the Northwestern and Illinois medical schools, used pencillin dust by inhalation in the treatment of 169 patients with common colds; 42% were cured. Thirty-eight were treated for acute and chronic sinusitis; 13 were freed of symptoms. Of 41 treated for acute and chronic bronchitis, 17 recovered. Of 24 treated for bronchial asthma, four were freed of symptoms.

The dust was inhaled three to six times daily from three to six minutes at a time.

Inhalation therapy with penicillin dust permits a patient to "go about his business without loss of time and with minimum expense," they point out, adding:

"Before the use of the present method, many patients with chronic pulmonary disease were not given adequate treatment because of the expense of prolonged hospitalization and equipment."

Medical supply houses market equipment for administration of penicillin dust.

Stainless Steel Wire for Closing Abdominal Wounds and for Repair of Herniae

Summary

In our experience the use of stainless steel wire makes the closure of large abdominal incisions a clean procedure which is completely secure. It eliminates the risk of post-operative disruption and herniation. No such complication has occurred in over 2,500 consecutive major laparotomies, a large number of which were for malignant disease of the alimentary canal. Its use has been accompanied by a considerable reduction in the incidence of infection. Skin scars are neater. It has enabled us with great confidence to practice very early post-operative ambulatory treatment, with the concomitant benefits of a reduced incidence of distension and of pulmonary and vascular complications.

The use of stainless steel darns in the repair of hernial orifices has simplified the operation. Any hernia, however large the defect, can be repaired by this method. The closure seems to be more secure than by any other method in that we have had no recurrence in over 300 cases over a period of nearly five years.

We are of the opinion that the strong, smooth, fine, innocuous filament of stainless steel is at present the best material at our disposal for the closure and reinforcement of fibromuscular planes. It must be used correctly, without tension, without strangulation of the tissues, and without kinking of the wire. —A. LAWRENCE ABEL and ALAN H. HUNT in *British Med. J.*

Wright, Bell and Habel, National Institute of Health, describe a method of cold benzene and ether extraction of brain tissue infected with rabies virus, by which rabies vaccine can be refined and concentrated. Its antigenicity also may be somewhat improved by the extraction of the lipid portion of the brain tissue.

Of the Canidae — dogs, wolves, coyotes, jackals, foxes, dingos — all are susceptible to canine distemper. The same is true of the bloodthirsty Mustelidae — ferrets, weasels, mink, skunk, martin. Of the Viverridae — civets, mongoose, meerkat, etc. — only one species, the binturong, is known to be susceptible to the virus of Carre and only a single species — the raccoon — of the Procyonidae is susceptible, according to L. J. Goss of the New York Zoological Park.

Dr. S. S. Elberg, University of California, reports successful experimental infection of monkeys, mice and guinea pigs by airborne Brucella organisms. He has measured the density of organisms in the atmosphere of stockyards and finds the concentration of Brucella sufficient to cause infection of those breathing it. He holds that airborne infection should be considered, along with contaminated milk and contact with infected animals, in attempts to determine the source of brucellosis in a given case.

Bacon an Inadequate Diet for Dogs

In an experiment in Holland, nine dogs were fed on fat bacon exclusively. Two died in 2½ and three months respectively. The only lesions were severe fatty degeneration of the livers.

Five died suddenly and unexpectedly in five to seven months. They were in bad condition, emaciated, and had suffered from vomiting, inappetence, diarrhea and dermatitis. The lesions included necrotic areas in the pancreas, kidney and cystic calculi, and almost complete replacement of parenchymous hepatic cells with fat.

Of the remaining two dogs one was given 10,000 units of vitamin A and 5mg of thiamine. It died in just over seven months in the same condition and having shown the same symptoms as the preceding five dogs. The lesions, too, were the same.

The ninth dog was given in addition to the bacon regimen 25 grams of raw liver daily. It remained in excellent health and condition for 13 months. Then the liver was discontinued and 25 grams daily of pancreas substituted. Five months later it died in the same condition as the animals fed bacon exclusively.

Among the major problems in the organic chemistry of natural products, that attracting the keenest interest of investigators is the constitution of proteins. — *Science.*

Proteins of First Importance in Rations

Magendie, a French physiologist during the early part of the 19th century, was the first to observe that proteins differed from carbohydrates and fats. Voit discovered that gelatin cannot be substituted for meat in the diet of the dog without loss of body protein. This was the first reported experimental evidence that the biological value of a protein was dependent upon its amino acid composition. Since then, more evidence has been accumulated to show the nutritional value of proteins is determined more by the amino acid content than the total percentage of protein in the ration. Requirements of an animal for one or more specific amino acids is not known. In other words, rations are not prepared today on the basis of the percentage of each of the known amino acids. The nutritional value of proteins can only be measured by animal growth. The proteins from animal sources are in general superior to those from vegetable sources.

From the animal kingdom the principal proteins used for fox and mink feeding are meat, fish, milk by-products, and eggs to a very limited extent. The biological value will depend upon the quality of the ingredient. Fresh meat contains approximately 18% protein. Fish (fresh or frozen) contains from 6% to 20%. Block and Bolling reported there is no difference between meat and fish muscle proteins except that lysine, an essential amino acid, is higher in meat muscle protein. Dehydrated meat, liver and fish meals contain from 50% to 70% protein; dried whey 11%; dried skimmilk 33%; milk albumin, 45%.

The approximate analysis of poultry by-products that are cooked and dehydrated is: moisture, 9%; protein, 56%; fat, 15%; ash, 14%; calcium, 4.5%; phosphorus, 2.25%. In some instances a part of the fat is drawn off, thus leaving a product that contains approximately 5% or 6% fat and an ash content of approximately 20%. This is one of the newer products on the market which has only been used to a limited extent in the ration of foxes and minks. However, the results have been very satisfactory.

An analysis of a ground composite sample of a number of dressed and eviscerated jack rabbit carcasses, including the livers, was: moisture, 65.34%; protein, 22.6%; fat, 5.8%; ash, 4.87%; calcium, 1.5%: phosphorus, 0.92%. Excellent results were obtained, prior to 1941, on many western fox and mink ranches from feeding jack rabbit meat as a replacement for horse meat.

According to Smith *et al.*, representative samples of muscle from 16 slaughtered horses averaged: water, 76%; protein, 18.1%; fat, 4.1%; ash, 0.6%. The fat was the most variable constituent of horse meat, ranging from 0.4 to 12.7%. The water content of the horse muscle apparently increased as the fat decreased.—Dr. R. R. McCrory in *Canadian Silver Fox and Fur.* (June) 1947.

A small amount of natural fat in the ration is essential for poultry, but since feeds that are rich in fat tend to become rancid in a short period, it is better and less expensive to keep the percentage of fat in the ration down to 5%. Birds synthesize fat readily from carbohydrates and, therefore, 5% of natural fat is adequate even for a fattening ration.

Raw Meat Requirements of Mink

Adult female mink will maintain their weight as well on a diet containing 40% raw meat as on one containing up to 60%. Breeding success, production of young, and freedom from litter destruction are as favorable at a 26% raw meat level as at 40 or 60%. Mink kits raised to 49 days of age on a ration containing 26% raw meat are significantly smaller than those fed 40 or 60% meat. No difference existed between the lots receiving 40 and 60%, and it is concluded that the most efficient ration for feeding mink kits up to 49 days should not contain more than 40% raw meat of a quality similar to horsemeat. The precise level may be somewhat below 40%.—*U. S. Fur Animal Experiment Station.*

Milk Hygiene

Filth and extraneous matter in milk can be determined easily in the field, and at the present time such tests are widely used both by the industry and regulatory officials on milk for use in manufactured products. Two hundred and seventy-two recent tests performed by inspectors of the Food and Drug Administration show that considerable quantities of milk containing large amounts of filth are received by cheese factories. Sediment test methods for cream used in butter making are available for use in the field.

Methods have been developed for the determination of filth and extraneous matter in cheese, evaporated milk, skim milk powder, etc. These are laboratory methods designed for use on finished dairy products. The microscopic identification of filth elements is a very important part of any determination of filth and extraneous matter in dairy products. —J. O. Clarke in *Am. J. Pub. Hlth.*

In an experiment to determine the effect of sunshine on ascorbic acid and riboflavin in milk, both were destroyed by exposure in commercial one-half pint bottles for one to two hours; the former completely and the latter to the extent of 85%.

Experiments at the Purina Research Farm show that the physiology of the rumen is disrupted and the normal performance of the animal disturbed by reducing the roughage intake below a needed minimum. It was shown that the digestive system of a lactating cow weighing approximately 1200 pounds ceases to function when the allowance of hay is reduced below 10 pounds per day.—*J. Dairy Sci.*

Three-fourths of all the calcium of the American diet is provided by milk and its products. Dairy products also supply almost half of the riboflavin, about one-fourth of the fat, nearly one-fourth of the protein, and 16% of the vitamin A consumed in this country. In addition, other known nutrients, as well as those yet unidentified, are provided in significant amounts, by dairy products.—*Kansas Stockman.*

Animal Breeding in Relation to Nutrition and Environmental Conditions

The action of the gene on the characters of an animal is limited to those manifestations which are physiologically possible if the gene is to survive. Environmental conditions affecting the physiology of the animal will therefore have a selective action on those genes which give rise to characters in harmony with the environment concerned. The main problem in animal breeding is to be able to direct the course of evolution and to select genes giving rise to increased development of certain characters.

Where the development of a character is limited by environmental conditions it is not possible to select for genes which have the capacity of manifesting themselves in excess of these environmental limitations. If, therefore, the physiological factor limiting this manifestation of the gene is removed by placing the animal under optimal conditions for the development of the character in question, then it is possible to select for genes giving a high level of production.

Owing to conditions affecting survival rate at birth, genetic control of reproduction has, under natural conditions, often become linked to variation in daylight hours. Egg production in hens depends on increasing hours of daylight and in sheep on decreasing hours, varying in degree according to the latitude of origin of the breed. Before progress can be made in the selection of genes concerned with this, the survival rate at birth has to be regulated by the control of environmental conditions.

Most commercially valuable characters in animals are quantitative rather than qualitative, so that it is the degree to which the character is manifest that is important. In breeding for high milk yield various physiological factors (letting down of milk, food intake before and after parturition, milk pressure, etc.) have in turn become limiting factors for further increase in yields, and further genetic selection for increased yields has not been possible until appropriate action has been taken to eliminate these limiting factors.

A disadvantage of the method of selection within a specially controlled environment is that the environmental conditions limit the scope of the genetic characters that can be selected for effectively. Thus selection for high milk yields in temperate climates is not directly applicable to tropical climates, for factors regulating body temperature in high air temperatures have not been selected for, and in tropical climates combination with genes for this latter character must be made before the genes for high milk production become effective.

In the selection of genes for meat production and growth the control of the plane of nutrition during the different phases of growth is important, for by this means control of the body proportions is obtained. The natural nutritive conditions under which the specialized breeds of pork, bacon, lard and native pigs have been produced, when repeated under experimental conditions on inbred lines, give the same types of individuals as before. Genetic selection would appear to be most effective if carried out in a nutritional environment favourable to the development of the character in question. Nutritional conditions affect post-natal to a greater extent than pre-natal development; on the other hand, genetic conditions are of greater importance than nutritional ones during pre-natal development because the uterine is more stable than the external environment.

It is suggested that by controlling the environment in which the next generation is reared, i.e. the uterus, man could direct the future evolution not only of his domestic animals but also of himself by selection of genes within this environment.—HAMMOND, J., in Memoir No. 19, University of Cambridge. Abst. from *Biol. Rev.* 22, pp. 195-213. 1947.

Foot-and-Mouth Disease Quarantine Line in Mexico Moved South the Third Time

An encouraging development in the fight against foot-and-mouth disease in Mexico was announced September 18 by USDA. This consists in a lifting of the existing quarantine from approximately 24,000 square miles of territory which has now been determined to be disease-free.

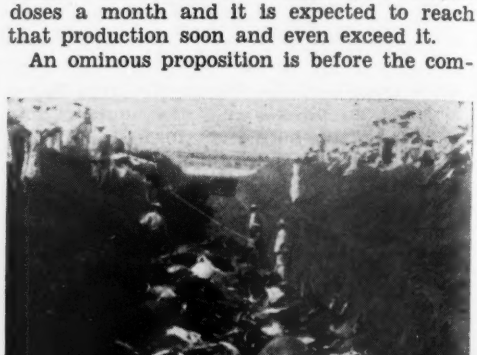
The relocation of the line southward marks the third shift southward of this line within a year. The total reduction in size of the quarantined areas as the result of the three changes represents an estimated gain of about 10% of the area originally quarantined.

Though following a somewhat irregular course, influenced by the terrain and the presence of roads and towns, the new location of the quarantine line represents an average southward movement of approximately 30 miles. Veterinary officials of the Bureau of Animal Industry regard this gain as significant, not only because of its substantial amount, but also as indicating the effectiveness of measures now being used to control and suppress the disease.

A further encouraging development in the present program is the incerasing production of foot-and-mouth disease vaccine by the laboratories of the joint commission in charge of the campaign, in spite of time-consuming technical requirements. Though established only a few months ago, the laboratories are now producing in excess of 100,000 doses of vaccine a week. Each lot is tested for safety and potency, which requires a period of at least four weeks in addition to the time required to produce it. Most of the animals vaccinated thus far are in zones bordering the northern and southern quarantine lines. Being resistant to the disease, the vaccinated animals serve as barriers to the spread of infection.

The war against foot-and-mouth disease has been going well in recent months notwithstanding the meager supply of vaccine that has been available to the fighters. Since most of the area freed from quarantine was not infected, but quarantined as a precautionary measure, the disease has not been eradicated from much infected territory. But extension of the disease has been stopped. That was not and could not be accomplished by the slaughter policy at first pursued. In addition, even the small amount of vaccine so far available has sufficed for eradication of the disease from areas in which all the susceptible animals could be vaccinated, and all infected animals slaughtered. The production of the Mexico City vaccine laboratory has been building up rapidly in recent weeks. Only a short time ago it was 80,000 doses a month. The theoretical capacity is 600,000 doses a month and it is expected to reach that production soon and even exceed it.

An ominous proposition is before the commission in charge of the eradication campaign. It is to entrust the vaccinating to laymen. This is urged by Mexican members of the commission. The success of the vaccinating program, for which they were solely responsible, has given them great confidence and they are not going to be easy to dissuade from putting the vaccine into lay hands under veterinary direction. The vaccine is injected intradermally. Comment seems unnecessary.



Eradication of foot-and-mouth disease in pre-vaccination days. This method of slaughter of infected and all in-contact susceptible animals is outmoded, except under special conditions.

Mastitis Makers

High barn sills; mud holes at sills; short stall platforms; narrow stalls; smooth concrete standings; insufficient bedding in cold climates.

Decentralization of Meat Packing

Not many years ago more than 40% of all meat animals slaughtered in abattoirs in the United States were processed at the Chicago packing houses. Now only about 10% are slaughtered at Chicago.

In 1920 hog slaughter in the rural areas of Iowa and Minnesota accounted for 39% of the total federally inspected slaughter in those states. By 1945 this percentage had increased to 67.

Tetany in Calves

Among the diseases of calves grouped together under the heading of tetany, the chief symptoms of which are crying out and convulsions followed quickly by death in most cases, there occurs a more closely-defined form, known in Holland as *spierlal.* In this form the symptoms are the same, but with a characteristic microscopic appearance of the muscles. A clinical study was made of a limited number of cases of this sporadic disease, about which little is known as yet and little is to be found in literature on the subject. In addition to the symptoms already mentioned there were two others, a disturbance of the cerebro-spinal axis and onset of blindness a considerable time before the convulsions. Vitamin A deficiency can most probably be ruled out. It was thought that the ration given was deficient in one of the milk fat components and that the condition was not related to the protein in the diet.—*Tijdschr. Diergeneesk.* 71. pp. 832-841. 1946. Abst. in *Vet. Bul.* 18:4, 1948.

Field Tests of a New Brucellosis Vaccine

Two hundred thirty Michigan veterinarians —more than half of the practitioners in the state who treat farm animals—are co-operating in the field test of the new (Huddleson) Brucella (M) vaccine. Not all the answers are available as yet, but to date the new vaccine appears to possess the following advantages over Strain 19 vaccine:

1. Rarely is there sufficient reaction in calves to cause them to go off feed.
2. It does not cause lowered milk production for a few days in lactating cows.
3. The positive reaction following vaccination is more evanescent than is the case with Strain 19; seldom lasting as long as 100 days in either young or adult cattle.
4. It may be used safely on pregnant cows at any time during the gestation period.

A co-operative, long-range, official test[1] of Brucella (M) vaccine has been undertaken by the livestock sanitary authorities of West Virginia, Maryland, Ohio, Pennsylvania and Virginia. Dr. T. C. Green, state veterinarian of West Virginia, is director of the experiment and the state veterinarians of the other co-operating states are associate directors. A technical committee comprising B. H. Edgerton, Ohio; W. L. Bendix, I. D. Wilson and W. B. Bell, Virginia; N. O. Olsen, West Virginia; and A. L. Bruekner and L. J. Poelma, Maryland, will assist the director of the project.

It will bear repeating that Brucella (M) vaccine is still under trial. It is not available for general use. It is not made under B.A.I. license and cannot be supplied to veterinarians outside of Michigan and only to those within the state who undertake to supply records of its use and the results over a period of several years.

1. *Vet. Med.* 43:9, p.359. (September) 1948.

Local veterinarians are indispensable as agents for the successful application of a control program in infectious diseases of animals. —J. M. VEILLEUX, Chief, Health of Animals Service, Province of Quebec.

On most dairy farms there is an occasional loss of calves, six to 12 weeks of age, from sudden death without having shown clinical evidence of illness. Necropsy in such cases usually reveals a hyaline, myocardial degeneration and gastroenteritis.

Twinning of Dairy Cattle

Based upon insufficient records to dogmatize, twin parturitions in the average dairy herd approximates one in 25; triplet parturitions one in 500. The variation in the amount of twinning in different herds is wide. Williams cites unusually healthy cattle where it was only 0.72:100 and severely diseased herds where it was 25:100 and even 50:100.

Multiple birth in the cow, a strictly uniparous animal, is a matter of inheritance, but may be influenced greatly by environmental factors. Multiple births, rare at the first parturition, increase percentage-wise during the next five.

Twinning in cattle is undesirable because the percentage of dead fetuses, of retained afterbirths and of dystocias are significantly greater than in single births. Also sterility is more frequent following multiple births and the interval to the next conception is on the average longer.

The production of twins or triplets is often looked upon as an evidence of exalted fertility and there have been suggestions for producing a biparous strain or family of cows through selective breeding. Williams looked upon twinning as evidence of prior disease or other disorder of the reproductive system, particularly of the ovary. He summarizes the situation thus: "Any critical analysis of bovine twinning, when ample material is used, shows beyond all question that twin gestation in the cow is disastrous. The abortion rate is many times that of single pregnancy; the mortality among twins is very high; the sterility following twinning is appalling; many of the viable twins are inferior in size and fertility, and a great many are asexual monsters — free martins."

Equine Accidents in the Fields of Sport*

By HENRY SUMNER, M.R.C.V.S., D.V.H.
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THE subject "Equine Accidents in the Fields of Sports" offers wide choice in its manner of treatment but probably the most suitable for the purpose of this contribution is to centre my remarks upon the experiences I have had while acting as veterinary surgeon to a race-course, part of the programs of which are made up of steeplechases which have a wide national and international interest.

The study of the close relationship of man and animal in the pursuit of sport and food is, in itself, one of absorbing intrest and offers a very large field for investigation and future recording. On the occasions when animals are called upon to particpate with man in the various forms of sport, they are exposed to the same risks of injury as their co-partners and thus an obligation rests on man himself to provide that the risks to be taken are not undue and unreasonable. Further, in the event of accidents arising, it is an added responsibility to provide help that is not only prompt but efficient.

Immediate attention is called for not only from the major aspect of the needs of the injured animal which demands that its requirements shall be fully met but also from the necessity of sparing the public the distress of viewing injured animals on the field or course.

Thus, a part of this service calls also for speedy removal of the animal from the public view. Furthermore, removal makes it possible for the veterinary examination to be carried out in more suitable surroundings and in a less emotional atmosphere.

At present, the methods available for the removal of injured animals, particularly the recumbent horse, are somewhat crude and far from satisfactory, and it is to be hoped that as soon as conditions allow, a concerted effort will be made to evolve more suitable vehicles and appliances.

After removal from the course, unless the injuries are such as to call for immediate destruction, the necessity for accurate diagnosis is great and need not be stressed. It arises not only from the desire to give every possible comfort and aid to the injured creature but also from the fact that the animal may be of considerable value and insurance interests may be concerned.

Accuracy of diagnosis is, on all too many occasions, a matter of difficulty and it is by no means an easy matter to form a clear view in many cases where a definite opinion is clearly and urgently required. Unfortunately it is not always possible to utilize that precious period of 48 hours or so after an accident, one which can be so helpful in assisting one to give views without ambiguity; in fact, a period which on so many occasions has been utilized by the injured animal itself to resolve its own problems.

In these difficult cases one is guided more by the degree of intensity of the symptoms rather than by their conforming with those of the accidental conditions so clearly depicted and graphically described in text-books. Except in those cases which by their very condition call for immediate action, definite opinions are best deferred as long as possible, for many animals are affected temperamentally by the surroundings, atmosphere and noises which are part and parcel of a race meeting in progress, and whose constitutional symptoms as a result of these extraneous factors, are apt to mask the material ones and lead one to views which later have to be amended.

In view of the primary importance of diagnosis in this aspect of the work, I propose chiefly to confine my remarks to points appertaining to the recognition of the conditions presented.

On more than one occasion I have been confused by the marked variations in the

*Presented at the 66th Annual Congress of the National Veterinary Medical Association of Great Britain and Ireland September 8-15, 1948 and supplied through the courtesy of General Secretary, F. Knight, Esq.

behavior and general reactions of injured horses to pain. This has been striking and although the factor is somewhat intangible in the abstract it is, nevertheless, very real, for whereas some horses are positively stoical in their endurance, others are sadly lacking in this quality and by their behaviour cause unfounded doubts and misgivings.

Of all the injuries encountered, it is those affecting some part of the spinal column which are the most difficult to assess accurately, both from the viewpoint of prognosis as well as diagnosis, but I find it most helpful to approach the case from the aspect of intensity of symptoms rather than from the exhibition of indications which might be considered typical. On more than one occasion I have seen cases in which every symptom, stated to be characteristic of serious injury to the vertebral column, was present, but they just lacked that intensity I regard as so important, and subsequent events, namely early and complete recovery, showed them to have been due merely to simple concussion.

Conversely, it is remarkable how severely damaged a vertebra can be in its several parts without causing death or even symptoms of serious embarrassment. Yet the slightest damage to the neural canal found on post-mortem examination is generally adjudged as being sufficient to have been either fatal at once or to have provoked symptoms which warranted immediate destruction.

I believe that if one is presented with a recumbent horse showing nystagmus, a slow and full pulse, complete paraplegia, a flaccid and semi-pendulous penis with dribbling urine, and an absence of caudal, anal, pedal and penial reflexes, one is reasonable safe in advising destruction. Nevertheless, even after a considerable experience of such cases, I am always much relieved to find on post-mortem examination full and sufficient grounds for my action.

It is generally accepted in cases of severe injury to the spinal cord that skin reflexes posterior to the lesion are absent and thus it is possible to locate by the line of demarcation between sensibility and insensibility, the exact position of the injury. This, however, is not a reliable factor for I have, on more than one occasion, provoked skin reflexes in some degree well posterior to a vertebra which on autopsy proved to be shattered.

Fractures of the uppermost cervical vertebra are mostly confined to their lateral processes and in the main do not give rise to much difficulty in diagnosis, for in view of the comparatively light covering of muscle, detection by palpation is generally possible. Subluxation has been encountered several times, but if such a case is seen early its nature is apparent and reduction is comparatively simple as compared with the case presented after delay.

Damage to the lower part of the neck is not so easily recognizable as that occurring in the higher region but in both instances posture and carriage of the head and neck are of great assistance in locating the injury. A case of depressed fracture of the odontoid process of the axis, in which the diagnosis was confirmed by X-ray, has been seen in which the horse recovered and raced again.

Dorsal vertebral injuries are not easily recognizable. This is due in large measure to the extent of the musculature in the area and damage short of shattering of a vertebra involving the neural canal is difficult to differentiate from fracture of the necks and arches of the ribs in the region. In my experience, severe dorsal injury is characterized particularly by a notable rigidity of body posture which is more marked than in the case of lumbar vertebral injuries. In cases of damage sufficient to injure the neural canal and meninges in this area, one can be misled easily by the persistence of skin reflexes well behind the focus of injury, but the other symptoms of broken back are present in marked degree; in fact, my experience has been that in fracture of any of the dorsal vertebrae involving the neural canal the intensity of the symptoms is greater than that observed in damage to any other part of the vertebral colunm. Fractures of the spinous processes of the dorsal veterbrae have been seen on several occasions but offer no difficulty in recognition.

Injuries in the lumbar region are very frequently associated with fracture of a vertebral transverse process and striking features of these cases are the rapidity of onset, the extent of local swelling, and the acuteness of the pain when the region of the injury is even lightly palpated. In one case seen, the fractured portions of the two transverse processes involved were depressed to the extent that they so severely lacerated the underlying psoas muscle and peritoneum as to cause considerable hemorrhage into the abdomen.

Pelvic fractures have been seen on three occasions. The first occurred in a horse which did not rise to the jump and blundered through it. The animal was unable to regain its feet. On examination, the uppermost hind leg, on flexion and extension, gave a peculiar sensation of looseness which suggested to me some damage in or about the femoral head, but rectal examination revealed a complete fracture through the pubic symphysis.

The second case was unusual. The horse,

which was leading a small field and had taken a fence perfectly, about ten yards after landing was noticed to shorten its stride and then to take two swaying strides and fall. On

manipulation of the uppermost hind leg, crepitus was not only felt but distinctly heard. Post-mortem examination showed fracture of the floor of the pelvis through both sides of the obturator foramen.

The third case arose when a horse after completing the course, showed distress on return to the stable. Examination showed some indications of flexor paralysis of a hind limb but simple rectal examination failed to reveal any fracture. Manipulation of the ischial tuberosity and of the opposite angle of the ilium, while the hand was still in the rectum, gave distinct signs of crepitus although the actual site of fracture could not be determined. However, at a second examination the following morning, it was easy to detect a complete fracture of the shaft of the ilium.

Rupture of the ilio-sacral ligament has been met with once. The case, while not presenting an acceptably complete picture of a broken back, led one to suspect injury to the lower part of the vertebral column by swaying movements of the hind limbs and later recumbency and inability to rise.

Rib injuries, which are seen quite frequently, fall into two groups. First, fractures just behind the articular head and of the top of the arch commonly accompany fracture of the adjacent vertebra and are thus noted as being present, often with lung puncture in some degree, at post-mortem examinations, but I have never satisfied myself that I have detected the condition in life. Secondly, there is the condition of crushed rib which occurs on the general curvature of the bone and gives rise to a curious flattening of the chest wall which is not difficult to recognize when several ribs are involved. I have not observed completely fractured ribs associated with lung puncture other than injuries at or about the head of the bone.

One case of scapular injury has been presented and it offered no difficulty in diagnosis as manipulation of the olecranon process gave distinct crepitus. Post-mortem examination showed fracture of the neck of the scapula.

Fractures of the humerus are common. They are mostly complete and generally easily recognized. Incomplete fractures without displacement are often difficult to locate. The use of the stethoscope for the detection of faint and indistinct crepitation sounds has proved of great assistance in dealing with injuries in this area.

Complete fracture of the ulna has been encountered not only involving the olecranon but also along the whole length of its union with the radius. The elbow joint appears to be particularly susceptible to injury during steeplechasing; a traumatic arthritis, easily noted but quite intractable to treatment and all too frequently resulting in erosion of the upper articular surface of the radius, is relatively common.

The diagnosis of injuries to the limbs in parts below the elbow and stifle joints is greatly helped by X-ray and the fullest possible use of this aid should be made.

Injuries to the metacarpal bone do not as a rule present great difficulties but in a recent case a fissure without displacement running diagonally across the bone was clearly indicated by X-ray, whereas lateral and frontal pressure applied to the bone did not provoke signs to suggest its presence.

Dislocation of the fetlock joint has been seen on two occasions. The first showed lateral displacement and was sufficiently complete for the foot to be almost at right angles to the metatarsal bone. Reduction was easy and most spectacular. In the second, the luxation was anterior and was reduced only after difficulty, considerable traction having to be used. In both cases a "Cellona" plaster of Paris cast was applied and in a short time the animals were fit to return home.

Injuries of the os suffraginis form a very considerable part of the total damage sustained in the fields of sport. An impressive feature of the writer's cases, however, is that a high proportion occurred while the horse

was galloping on the flat without visible accident and were not in any way connected with a fall or stumble on landing after a jump.

Complete and multiple fractures of this bone present little difficulty in diagnosis but single fissures may be hard to locate and although lateral and frontal pressure together with slight rotation may give suggestive indications, injuries in this area call for the fullest use of X-ray.

In the hind limbs, femoral fractures are relatively frequent and despite the heavy muscular covering are, as a rule, readily recognized. The majority are complete with displacement. The writer's cases have been confined to the lower third of the bone.

A case of luxation of the patella occurred while a horse was returning to stables after completing the course. The luxation was inwards and the displaced position of the patella could be palpated readily. Happily, the incident took place in the paddock; the horse became completely immobile and replacement was easily accomplished by pulling the leg forwards by means of a leading rein passed around the fetlock.

Dislocation of the hock through the tarsal bones has been met and the deformity of the joint was great. As effective reduction of the condition seemed unlikely the owner, very properly, consented to euthanasia.

Complete rupture of the superficial and deep flexor tendons in both hind limbs has occurred. The case was notable for the facts, first, that the accident took place as the horse was galloping on the flat; second, that the soles of both feet were visible when the horse was viewed from the front; third, and most striking of all, that the horse made a complete recovery and was subsequently raced again.

On two occasions I have been called to attend horses after racing which were found to be suffering from recurrent spasm of the diaphragm. Both cases were violently convulsed by the spasm and there was acute constitutional distress. As the first case showed an early satisfactory response to small and repeated doses of "carbachol" its use was repeated in the second with the same happy result.

To conclude this review of cases seen in this realm of sport, I would quote that of a horse which when leading its field either interfered with or was interfered with by another horse at the last jump and both fell. The horse in question was remounted and finished third, but while being unsaddled in the paddock it collapsed and died. Post-mortem examination showed an extensive rupture of the diaphragm with gross herniation of intestines into the thorax.

Observations on the Pathogenicity and Viability of Ostertagia Ostertagi

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Introduction

IN connection with the study of the life history of *Ostertagia ostertagi* it seemed advisable to attempt additional studies of the pathogenicity and certain biological aspects of the parasite. This involved a determination of the effect the parasite produces in the individual animals employed. To interpret adequately, the results obtained, it seemed necessary to consider the relative physical status of animals before they were given the infective larvae of *O. ostertagi,* during the period they were receiving the larvae, during the time intervening before the post-mortem examination, and at necropsy. A comparison of the blood pictures of infected and uninfected calves was then made from a statistical analysis of the data available. The second portion of the study consisted of field tests for viability of the infective larvae, when subjected to the local climatic conditions. The literature reveals no reports dealing with detailed studies of *O. ostertagi* comparable to the study herein reported hence, literature citations are few. The only reference dealing with the viability of *O. ostertagi* larvae is that incidentally reported by Porter[1] in a paper on the survival of lung-worm larvae on pastures in which he reports the viability of *O. ostertagi* to be approximately six months in Alabama.

Methods

The first step in the general procedure was to establish an infection in animals which would serve as a reservoir of infective larvae for experimental use in parasite-free calves. Fresh fecal material was obtained from a herd of calves on a nearby farm for this purpose. This material was cultured and the larvae so produced were fed to a calf. Upon slaughter, this animal yielded an almost pure infection of adult *O. ostertagi.* The female worms were macerated and mixed with sterile feces and charcoal to which was added a little distilled water. After a period of seven days the culture was placed in a Baerman's apparatus and the larvae were drawn off and fed to a parasite-free calf. By repeated oral administration of larvae, obtained from fecal samples of this infected animal, sufficient infection was maintained to furnish infective larvae for other calves.

Permanent records were kept of all animals utilized. These records included the age, blood picture comprising erythrocyte, leucocyte, and differential counts, hemoglobin determinations, egg counts, and benzidine tests for blood in feces. All notations were made before and during the periods of experimental infection.

A description of the animals experimentally infected follows:

Calf 13.—This was a Holstein female calf, six months of age, and received an initial oral infection of 125 infective *O. ostertagi* larvae. A month later multiple doses of 1,000 larvae each at from three to 10-day intervals were given orally over a period of about two and one-half months. It received a total of 12,408 infective larvae. This animal was slaughtered at the age of nine months. At that time 300 adult Ostertagia, one female Nematodirus, and one female whipworm were found. The abomasum was highly inflamed and densely studded with small white ulcers. On the date of necropsy, six days after the final feeding of larvae, the blood picture was characterized by a sudden increase of 17% in neutrophils and a decrease of 15% in lymphocytes. No other irregularities were noted. The benzidine test remained negative throughout the experimental period.

Calf 82.—The initial dose of larvae given to this animal, a Holstein male calf, six months of age, was 2,191. A total of 49,390 larvae was administered over a period of one month; the average interval between doses being 2.4 days, and an average dose 3,799 larvae. Two months and eleven days after the last oral administration of the larvae, a necropsy revealed 1200 adult Ostertagia worms; 17 of them being found in the duodenum, the mucosa of which was studded with slight petechial hemorrhages. Gross examination of the abomasum showed only minor effects from the parasites. The blood picture remained unchanged and indications of a pathological nature during the experimental period of infection and at autopsy were negligible.

Calf 83.—The third animal, a Holstein male calf, was five months of age when it was given an initial dose of 45,000 larvae, October 29, 1943. This dose was followed in six days by a second numbering 34,000 and after a lapse of three days a third dose of 30,000 infective larvae. After a period of four days the animal was given 5,400 larvae which was followed in nine days with 15,000 more larvae. Thus within a period of 23 days an aggregate of 129,400 larvae were administered. December 12, 1943, the peak of the egg burden was reached with a count of 286 eggs per gram of feces. The animal was killed approximately four months after receiving the final dose of larvae. There was no radical change in the erythrocyte or leucocyte counts, nor in the hemoglobin content, or in the differential counts during the life of this animal. Ninety-five adult *O. ostertagi,* many of which were senile, were recovered from the abomasum, but there were no gross pathological lesions. Five adults were found in the duodenum, but no gross lesions occurred. A microscopic study of stained

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sections revealed no lesions in the stomach nor small intestines.

Calf 84.—This was a Holstein male calf, two months and seven days of age when it received, December 7, 1943, an initial dose of 180,000 infective larvae. This was followed by additional oral doses of infective larvae as follows: December 10, 1943, 12,250; December 15, 1943, 17,860; and December 23, 1943, 6,273; total of 216,373 larvae in a period of 16 days. The highest egg count, 256 eggs per gram of feces, appeared January 1, 1944. After this date and extending to May 16, 1944, small doses of infective larvae were given periodically, and aggregating 47,487 larvae, making altogether a total of 263,856 larvae given to this calf. April 26, 1944, there was a slight drop in the erythrocyte and leucocyte counts and in the percentage of hemoglobin in the blood. Differential studies revealed no significant blood changes. With the exception of one positive benzidine test for blood in the feces before the animal was infected, this test remained negative throughout the duration of the infection. No other pathological indications were observed. The animal was autopsied July 12, two months after it had received the final dose of larvae. At that time 556 adults were recovered. Sections from the abomasum revealed no developing parasites.

Calf 97.—A Guernsey calf, two months and one week of age, received an initial dose of 8,000 *O. ostertagi* larvae May 22, 1944, and thereafter an average dose of 4,000 larvae at intervals of not less than a week and not more than three weeks with a final dose of 18,000 on February 21, 1945; a total of 148,000 over a period of seven months. Apparently this animal received sufficient larvae at proper intervals to cause general symptoms of parasitism and it seemed that there was manifested some evidence of the pathological effects of the parasite upon the host animal. In the final count of erythrocytes, made January 2, 1945, there was a drop of 1,280,000. There was also a fairly consistent decrease in the percentage of hemoglobin from the original reading of 87% May 16, to 62% on the final reading. There was an increase during this period of 5% in the neutrophils and a decrease of 14% in lymphocytes, as compared to initial readings. This change in the blood picture of sheep suffering from worm infections, has been noticed by other workers.

The benzidine test remained negative until February 21, 1945. On this date and on February 27, 1945, four days before the animal was slaughtered and 10 days after it received the last dose of larvae, the benzidine test became positive. On gross examination there was considerable more evidence of necrotic and edematous changes in the mucosa of the abomasum than in the other animals. One thousand adult worms were recovered from the abomasum and numerous immature *O. ostertagi* were observed in stained sections of the wall of the abomasum. Fifty-five *O. ostertagi* and 20 *C. oncophora* were removed from the duodenum. No other parasites were found. In the individual cases reported it was not possible to correlate the egg burden with the blood picture nor with the number of adult worms recovered at necropsy.

Calf 99.—This calf served as the control animal. The mean of the blood determinations are given in Table I. (Initial age five months, age at necropsy 12 months.)

In this animal, with the exception of the leucocytes in which the highest count was 12,000 and the lowest 6,600, there was only slight variation in the readings recorded.

TABLE I.—SHOWING THE MEAN OF BLOOD PICTURE OF CALF 99

Erythrocytes	Leucocytes	Hemoglobin	Polymorphs	Eosinophiles	Basophils	Lymphocytes	Monocytes
7,500,000	9,600	85.9%	24.5%	.9%	.7%	71.7%	2.1%

Pathological Lesions Noted in Calves Experimentally Infected With Ostertagia ostertagi

Tissues taken from both the fundus and pyloric regions of the abomasums, of the group of calves previously described, were fixed in Helly's fluid, sectioned at 12 microns, and stained with hematoxylin and azure-eosin. Materials were obtained also from calves fed infective larvae of *O. ostertagi* and examined at intervals ranging from 72 hours to 10 days afterward. The most constant and predominating lesions consist of an erosion of the glandular epithelium. Plate I. Fig. 1. In some instances, with continuous infection, these white eroded areas of the mucosa were noticeable on gross examination; appearing as tiny white plaques. On microscopic examination of sections, taken as early as 72 hours after ingestion of the larvae, such erosions appeared to extend, in many instances, from the orifice to the base of the gland. Not infrequently, coiled larvae were found in the lumen of the glands near the base in the region of the muscularis mucosa. In only one instance in a section taken from a calf 10 days following feeding of the larvae, did it appear that the larvae were outside the lumen of the gland. In this instance an exudate with round cell infiltration appeared around the larvae. Plate I, Fig. 2. In this study, therefore, it appears that the larvae are usually located in the lumen of the glands, but occasionally bore into the mucous membrane and assume a position near the muscularis mucosa. A cellular reaction surrounding the larvae results in the latter case.

An increase in the amount of mucus present was observed in practically all sections containing larvae as compared with sections from abomasums of calves free from these parasites. In many sections containing larvae

there seemed to be an increase in the number of tissue eosinophils present. Plate I, Fig. 2. On the other hand the blood picture of these animals revealed no marked increase in eosinophils in the blood.

The pathological processes in the animals in this study were less pronounced than those described by previous investigators in naturally infected animals. This is undoubtedly due to the degree of infection present and the conditions under which the animals herein described were maintained. However, there may be other factors involved. It is conceivable, that the extent of erosion and perhaps adverse effect upon the function of the glandular epithelium with these larvae present may account for the symptoms usually noted in naturally infected animals. Since frequently, from one to three larvae were present in sections one-half inch in length and twelve microns thick, by calculation, one finds that the infection present was much heavier than ordinarily would be experienced. With these numbers of larvae present there is undoubtedly a physiological handicap to the normal digestive processes in these areas. The lesions found, however, did not seem to be of the degree of severity which one might expect in animals that manifest a clinical picture of severe parasitism. It is interesting to note, especially in Calf 97, that the inflamed and edematous condition of the abomasum was more pronounced in calves harboring developing larvae than in calves infected only with adult worms.

Erythrocyte, Leucocyte, Differential Counts and Hemoglobin Determinations

In the course of this study of the pathological effect of *O. ostertagi* upon its host animal, an effort was made to establish a practical basis by which a comparison of the blood picture of infected and uninfected calves

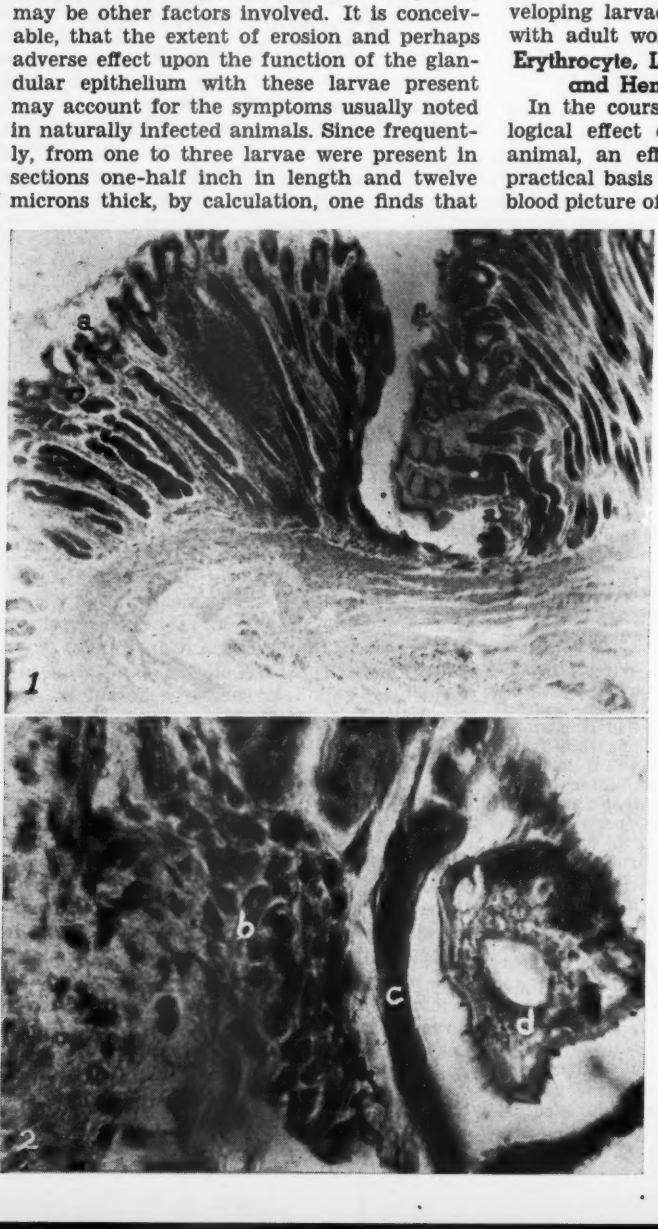

Fig. 1.—Photomicrograph of abomasum of calf No. 97. Note erosion of glandular epithelium at a.—X80.

Fig. 2.—A similar section at higher magnification. Note O. ostertagi larva cross-section at d., round-cell infiltration and mucous surrounding larva at c., and group of tissue eosinophiles at b.—X336.

could be made. Since all of the calves were slaughtered before they were one year of age, were maintained under identical conditions and were infected with the same parasite within the duration of twelve months, it appeared that the data obtained could be statistically analyzed. It became evident, however, in making this analysis that any conclusions based on the comparative results must be modified to allow for variations in symptoms due to quantitative differences in the numbers of infective larvae employed and the individual differences in possible immunity produced. Blood samples were obtained from all calves, both before and after oral infection and nine samples were obtained from an uninfected animal over a period of seven months. The blood was taken from the marginal ear vein and counts were made in an improved Neubauer hemocytometer. Duplicate counts were usually made, especially if a poor distribution of cells was evident. Hemoglobin determinations were made by the acid hematin method in a Fisher electro hemometer. Duplicate blood smears were obtained at the time the other samples were taken and stained with Wright's stain. One hundred and fifty cells were counted and the average of the two slides was recorded. The period during which the blood was obtained from the uninfected animals included the date of the initial sampling at the age of two months through the final sampling at the ages of from five to 12 months. From two to five samples from each animal were thus obtained. The length of the periods during which the samples were obtained from infected animals approximated the periods for uninfected animals. More samples from each of the infected animals were obtained and the total number was greater than the number of samples from uninfected animals as indicated in the table.

With the exception of a decrease in hemoglobin, recorded in Table II, to 69.71% in the infected calves, the mean results of the readings from the uninfected calves appeared to present greater variation from the normal than the infected; since they showed a slight increase in neutrophiles and a decrease in lymphocytes. In only two infected calves, viz. calf 13 and calf 97, were departures from the normal indicated.

Viability Experiments

In 1933-34 and 1937-38, experiments were conducted to ascertain the viability of the infective larvae of the sheep parasite *Ostertagia circumcincta* in pastures. Under the conditions obtaining in these experiments, it was concluded that the infective larvae of this species are able to exist under natural local conditions and maintain their infectiveness for from five to 11 months.[3] In the course of a study of the biology of *O. ostertagi*, the medium stomach worm of cattle, experiments similar to those conducted in 1937-38 with *O. circumcincta* have been undertaken at this station.

Materials and Methods

The animals utilized were young calves, four to five months of age. These calves, taken from their mothers two to three days after birth, were isolated in large, clean, concrete-floored stalls, bedded with fresh, well-cured wheat straw which was replaced every two weeks.

After two to three months, the animals were gradually weaned of milk and fed well-cured hay and a 16% protein dairy grain mixture. As soon as the calves consumed this grain readily, 15 to 20 grams of phenothiazine was added every 15 days. Seven days before they were placed in the infected paddocks, they were given four grams of phenothiazine daily until they had received 20 grams.

TABLE II.—SHOWING BLOOD PICTURE OF UNINFECTED AND INFECTED CALVES

Blood Analysis	Normal Calves			Infected Calves		
	No. of Samples	Mean Value	Stand. Dev. from Mean	No. of Samples	Mean Value	Stand. Dev. from Mean
Hb. per cent	26	82.35	2.1782	48	69.71	.9555
R.B.C's million per c.mm.	29	9.11	.4276	49	8.61	.3106
W.B.C's Thousand per c.mm.	28	10.03	.4471	47	10.78	.4071
Polymorphs per cent	17	25.83	1.4867	33	21.85	.8648
Lymphocytes per cent	17	68.82	1.7680	33	74.05	.9801
Monocytes per cent	17	4.07	.6787	33	2.74	.3690
Eosinophiles per cent	17	.94	.2032	33	1.14	.2121
Basophils per cent	17	.52	.1939	33	.52	.0866

TABLE III.—SHOWING POTENTIAL INFECTIVITY OF PADDOCKS FROM JULY 26, 1945 TO FEBRUARY 8, 1946

Calf No.	Dates of exposure	Initial Infestation O. ostertagi	Extraneous Species Present	Egg Burden & Larvae Before-exposure-after	Species found at	Necropsy Extraneous Nematodirus
A & B	6/15/45-7/26/45	400	Nematodirus	14 eggs Eggs 2	Adults 400	Present
	1 mo. - 11 days	larvae		per gram Larvae 0	Eggs per gm. 0	Present
1	Date Necropsy 7/26/45			feces	Larvae per 100 gms. 0	-
A	9/1/45 -9/15/45			Eggs 0	Adults 4000	Present
	14 days	None		0 Larvae 0	Immature worms in mucosa	
2	Date Necropsy 9/30/45		0		Eggs per gm. 2	Present
					Larvae per 100 gms. 30	-
B	9/15/45-10/1/45			Eggs 0	Adults 1000	Present
	16 days	None		0 Larvae 0	Immature 100 in mucosa	
3	Date Necropsy 10/15/45		0		Eggs per gm. 300	Present
					Larvae per 100 gms. 0	-
A	11/2/45-11/19/45	None		Eggs 0	Adults 100	Present
	17 days			0 Larvae 0	Immature 31 in mucosa	
4	Date Necropsy 11/27/45		0		Eggs per gm. 2	Present
					Larvae per 100 gms. 0	-
B	1/1/46 -1/15/46			Eggs 0	Adults 21	Present
	Exposure 8 days	None		0 Larvae 0	Eggs per gm. 0	Present
5	due to weather Date Necropsy 2/4/46		0		Larvae per 100 gms. 50	-
A	1/23/46- 2/8/46			Eggs 0	Adults 10	Present
	Exposure 7 days	None		0 Nemato-dirus 4	Eggs per gm. 2	Present
6	Date Necropsy 2/26/46		0	Larvae 0	Larvae per 100 gms. 15	-

Fecal samples from the calves were examined for eggs and cultured for larvae before they were turned on to paddocks, when they were removed from paddocks, and at necropsy. Upon removal from the paddocks, the calves were again isolated in concrete-floored stalls which had been cleaned, disinfected and bedded with fresh well-cured straw.

The paddock utilized for the experiments measured 15 feet by 30 feet and had been broken several months in advance and seeded to blue grass. The resulting vegetation consisted of a mixture of orchard and blue grass.

A five-months-old calf was infected orally with approximately 400 infective *O. ostertagi* larvae and placed on the paddock June 15, 1945, for a period of one month and eleven days. At the time of the oral infection, the calf was showing in the feces *Strongyloides papillosus* eggs and two to four Nematodirus eggs. Incidentally, Nematodirus eggs in small numbers appeared in each calf just before necropsy, and in one case, on the date of return to the stall. *S. papillosus* eggs were rather numerous in some animals before they were placed in the paddock, but disappeared almost entirely during the period of exposure and reappeared to some extent, after the calf was returned to the stall. None of this species was found in the abomasums at necropsy. Calf 1, employed for the initial infection of the pasture, revealed 400 adult *O. ostertagi* in the abomasum and few Nematodirus species in the duodenum. No other species of intestinal worms were found.

The infected paddock was divided into two portions of approximately equal size. The resulting small paddocks were designated A and B and were employed alternately to test the viability of the larvae. The calves were allowed to graze on the paddocks for periods of from seven to 17 days as indicated in Table I. The shortest time required for eggs to appear in the feces, as observed in the life history study, was 23 days. Mature worms were present at 21 days. Weather reports taken at the station are recorded for the entire period in which the study was made. See Table IV. Only the maximum and minimum, mean temperatures and the precipitation in inches are recorded in this study.

The work done in 1945-1946 has been repeated as herein described. On June 1, 1947, a calf four months of age was infected with the infective larvae of *O. ostertagi* and allowed to graze on a paddock until July 18, 1947, at which time it was removed. Subsequent necropsy showed that the calf was infected with *O. ostertagi* and a few Nematodirus. June 1, 1947, a calf weaned from its mother at three days of age was isolated in a pen containing an elevated slatted floor. This animal, like the calf employed subsequently, was given three grams of phenothiazine approximately every ten days over a period of six days and fecal samples checked for eggs. Entrance into the pen was not permitted at any time. September 4, 1947, the calf was placed on the paddock previously

infected and kept there for 16 days. It was then removed to a clean concrete-floored stall and after seven days slaughtered. Adult Ostertagia were numerous as two thousand were counted. The abomasum was cleared as previously mentioned and fifteen packets containing approximately 50 eggs per packet were removed from the mucosa and mounted on slides. No larvae were observed.

TABLE IV.—WEATHER REPORT*

	Temperature F. (Min.)—Mean	Temperature F. (Max.)—Mean		Precipitation Total
June, 1945	80.9	55.0		2.32
July	83.3	59.4		5.04
August	83.1	58.2		2.94
September	79.1	57.2		6.12
October	66.6	39.3		1.42
November	56.8	33.1		3.26
December	37.2	22.0		4.71
January, 1946	44.4	25.7	lowest Temp. 4°	3.58
February	50.0	26.0		2.20
July, 1947	77.8	55.5		4.60
August	84.3	62.3		4.64
September	75.3	54.7		3.82
October	68.3	46.4		5.10
November	47.5	33.1	lowest Temp. 23°	2.62
December	46.3	24.3		.50

*Complete records retained on file.

November 17, 1947 a four-months-old calf maintained as previously described was placed in the same paddock and removed on December 1, 1947 to a stall. A necropsy was held December 8, 1947. Four adult females and three undeveloped females, were removed from the lumen of the abomasum, and one larva, apparently about 10 days old, was removed from the wall of the mucosa. The period from July 18, 1947, to December 1, 1947, (four months and 23 days) represents the duration of the viability of Ostertagia eggs and larvae.

The lowest temperature registered during this period (See Table IV) which might effect the development of larvae was November 18, 1947, (23° F. above zero).

Discussion

Table III reveals that the initial infection was not great. It also shows that the first animal exposed (Calf 2) harbored 4,000 adult worms, the heaviest infection of the experiment. The egg-count of this animal at necropsy, in proportion to the number of adults found, was the lowest of any animal utilized. The number of larvae cultured from the feces was not great. Immature worms found in the mucosa of the abomasum were very numerous but were not counted. In the remaining four calves, tissues comprising the entire abomasum were cleared in creosote and the worms removed and counted.

Examination of Table III indicates that egg counts and fecal cultures were not indicative of the degree of infection, nor were they accurate tests for declaring the presence of the parasite in the host animal.

The number of adult worms decreased as the time increased from the date of the initial exposure. The period of exposure of the last two animals was only eight to seven days, respectively. Here weather conditions rendered these exposure periods short. The time which elapsed between July 26, 1945, and February 8, 1946, (Table III) approximately six and one-half months, represents the duration of residual infection on the ground, resulting from initial infection of the paddocks by Calf 1. The lowest temperature was 4° F. above zero on January 23, 1946. It may again be noted that continuous Nematodirus infection of the host animal was evident but as Nematodirus eggs were found in the last calf when it was returned to the stall, it is felt this species might have been present in an immature form in the other animals before they were turned into the paddocks.

From these experiments and those completed in 1946-1947 it is concluded that the infective larvae of *O. ostertagi* may remain viable on paddocks under the prevailing weather conditions of this particular region for a period of four to six and one-half months (July to February).

Summary

1. In calves 82 and 83, five to six months of age (initial age) receiving a total of 49,390 to 129,400 infective larvae over a period of 23 days to one month and autopsied 71 to 120 days after the final dose, no pathological effects were observed and no developing larvae were found in the walls of the mucosa of the abomasum.

2. In calf 84, two months and seven days of age, receiving 216,373 larvae in a period of 16 days and an additional 47,489 larvae in small doses over a period of five months and autopsied two months after the final dose, the blood changes were insignificant and sections from the abomasum revealed no lesions containing developing parasites.

3. In calves 97 and 13, two months and seven days and six months of age, respectively, receiving a total of 148,000 and 12,408 infective larvae in doses of 4,000 and 1,000 periodically over periods of seven months and two and one-half months and autopsied ten days and six days after receiving the final dose, there were definite pathological lesions. No sections were obtained from Calf 13. Sections from abomasum of Calf 97 revealed numerous developing

parasites in the walls. In this animal also, there was a definite downward trend in hemoglobin. In both animals there was neutrophilia and lymphocytopenia.

4. Lesions caused by developing larvae were characterized by round cell infiltration sur-

rounding the larvae, localized eosinophilia, edema and erosion of the mucosa, and in some instances the *muscularis mucosa* was involved.

5. Statistical analysis of blood-cell counts and hemoglobin determinations of infected and uninfected calves showed significance only for hemoglobin. The mean value of hemoglobin in 48 samples from infected calves was 69.71% with a standard deviation from the mean of .9555. The mean value of 26 samples obtained from normal, uninfected calves was 82.35% with a Standard deviation from the mean of 2.1782.

6. The infective larvae of *O. ostertagi* were found to remain viable and infective on paddocks in this locality of Virginia for periods varying from four and one-half months to six and one-half months. The tests were made from July 26, to February 8, 1945-46 and from July 18 to December 1, 1947.

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"X Disease of Cattle"

This ailment has been a popular one for discussion at various recent veterinary meetings. It is somewhat remarkable that after seven years (it was first reported in 1941) it is generally called "X", meaning "unknown" disease. Two names, each indicating a characteristic symptom, have been suggested—proliferative stomatitis and esophagitis (Udall) and hyperkeratosis (Gibbons). Neither seems sufficiently comprehensive to satisfy clinicians.

The disease appears to be contagious, yet attempts to communicate it by inoculation have not succeeded. Usually its appearance in a herd is preceded by the addition of a new animal, but such is not always the case. It occurs in two forms, acute and chronic. In the former, from 25 to 50% of the herd usually succumb within a month or two. In the latter, the disease may last for years, if the herd is maintained by replacements, but in the end the mortality is pratically 100%.

It is unlikely that all cases are recognized or that the extent or incidence of the disease is appreciated by veterinary practitioners or by livestock sanitary authorities. The federal Bureau of Animal Industry has been making a survey with a view to learning where the disease exists and how much of it there is, preliminary to further study of it.

The symptoms vary somewhat in different herds and particularly in different parts of the country, but certain of the manifestations of this disease are fairly constant among which may be mentioned, (1) rapid loss of flesh, (2) stubborn diarrhea at the beginning of an attack or within a week of the first evidence of the attack, (3) abortion of pregnant animals or if the young are born alive they suffer an extremely high mortality as do the cows also, post partum, (4) practically all cases that become chronic develop a marked thickening and scaliness of the skin over the head and neck and sides and the wrinkled appearance of advanced cases of mange. Common but less constant symptoms include chronic nasal discharge, clouded cornea, lachrymation and sunken eyes, frequent urination, mucopurulent vaginal discharge, pale mucous membranes, ulcerated areas in the mouth, pharynx and esophagus and "patchy" inflammatory areas along the intestinal tract. Acute cases are easily confused with malignant catarrh. Chronic cases may be mistaken for mange.

Veterinarians encountering cases of hyperkeratosis (chronic), proliferative stomatitis or X disease should report them, that more may be learned of the extent and prevalence of this ailment.

Comments Upon Animal Health Factors

By R. R. DYKSTRA, D.V.M.

Veterinarians in cattle producing communities learn to distinguish between the words "fodder" and "stover" as applied to roughages. To some city veterinarians it may be news that "fodder" designates the whole plant including the grain, while "stover" is the plant without the grain or seed.

Good quality roughages should be palatable, rich in calcium, with liberal carotene or provitamin A content, and with relatively high total digestible nutrients. A dairy cow in production should receive daily eight pounds of roughage for maintenance and an additional 0.32 pound for each pound of 4% milk she produces.

The claim of Russian researchers that *Trypanosoma cruzi*—the specific agent in Chagas' disease—is cancerotropic has not been substantiated by American scientists, in fact, death among treated cancerous animals was often more rapid than in untreated controls. The American opinion therefore is that *Try. cruzi* does not offer any promise in the field of clinical therapy.

Home grown feeds, especially if non-leguminous in character, are most likely to be deficient in protein. Animals must have protein to live. Proteins in turn are combinations of amino acids and of the latter 22 have been identified. The 22 are subdivided into "essential" and "non-essential" amino acids. The animal body cannot synthesize the "essential" amino acids and therefor these must be included in the ration. The "essential" amino acids—10 in number—are lysine, tryptophane, histidine, phenylalanine, leucine, isoleucine, theranine, valine, arginine, and metheonine.

Parry in *The Veterinary Record* (Vol. 60 No 32,) discusses informatively "Canine-Hysteria in Relation to Diet". The work was done at the University of Wisconsin under the auspices of the Commonwealth Fund Fellowship. Parry discounts the significance of vitamin A, and B, and lysine deficiencies. His findings stress the nature of a diet containing wheat flour that has been bleached with nitrogen trichloride—the "agene" process. This he regards as a *primary hysteriagenic agent. Neuro—psychological factors,* (loud noises, unusual situations, nervousness from constipation, ascariasis and foreign bodies), *secondary dietary factors,* (high fat—low carbohydrate), and *metabolic factors,* (water and electrolyte balance, over-saturation with vitamins, state of the sexual cycle, and exercise) are regarded as "hysteria-precipitating" in those dogs made "hysteria prone" by the *hysteriagenic agent.*

In South Australia *loss or absence of crimp* in the wool of sheep has been ascribed to a copper deficiency. The condition is known as "coast disease". It is prevented by the daily administration of 5mg of copper sulphate. A daily dosage of 50 milligrams caused copper poisoning.

There is a rather well formed theory that so-called cobalt deficiency in cattle is in fact a vitamin B_1 (thiamin) deficiency. Previous knowledge has demonstrated that in cattle vitamin B_1 is synthesized because of the action of the rumen flora. The theory is that this action needs the synergistic support of cobalt for the synthesis of vitamin B_1 to take place.

From Imperial Bureau of Animal Nutrition, Rowett Institute, Aberdeen, Scotland, comes the report that animals pastured on copper deficient grasses—the blood, liver and milk was demonstrated to be low in copper—responded when 1% of copper sulphate was added to the regular salt allowance. The clinical symptoms observed in affected animals were scouring, incoordinated gait, swayback, abnormal wool growth, degenerations in the central nervous system, "falling disease" and sudden death.

B.A.L.—named after the initials of British-Anti-Lewisite—originally developed as an antidote against the gas lewisite for local application in the form of an ointment is now used in a mixture of peanut-oil and benzoil benzoate as an intramuscular injection. Research seems to have demonstrated that so used it will counteract or nullify the effects of the salts of arsenic or mercury after their absorption into the tissues by combining with them to form a harmless compound. There are possibilities in B.A.L. for veterinary use in the treatment of advanced cases of poisoning in cattle following the accidental consumption of arsenic in grasshopper poisons. Therapeutic overdosing by any mercurial or arsenical would be responsive to B.A.L.

A Brief History of the Veterinary Science in China*

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THE term "shu-i", meaning veterinarian, according to Western and Chinese literature, was first officially used during the second reign of the Chou Dynasty in China about 1120 B.C.; a long time before the Latin word "veterinarius" began to be used. It is said that the progress of the veterinary art, in ancient times, was influenced by the study of human medicine. As a matter of fact medical science would not have made such rapid strides without a reciprocal relationship with veterinary science, as one will be convinced by tracing the historical development of both. Since dissection of the human body was prohibited in the early days, it seems indubitable that animal dissection made important contributions to study of the human anatomy. A large number of organisms, which are communicable from animals to man, and the disease they cause, were studied with success both as regards their treatment and prevention. In this way veterinary science proved beneficial to human welfare. Furthermore, in the olden days the knowledge of pharmacology was increased through the observations on animals employed for testing the efficacy of the drugs, just as the laboratory animals are used today. Thus we may agree that veterinary medicine has a long history parallel to that of human medicine.

Historical Background of the Ancient Veterinary Medicine in China

It is accepted in Chinese medical circles that medical knowledge may be traced back to the period of Shen-Nung (2737-2705 B.C.), who has been generally recognized by historians as the first to discover the properties of hundreds of herbs through personal experiments to determine which were poisonous and which were of value to medicine. Whether the veterinary pharmacology was developed contemporarily is not certain, but highly probable. The following statement, which was partially translated from the Alois-Koch's *Encyklopaedie der Tierheilkunde une Tierzucht* (1898) in which at the beginning the author laid an emphasis upon the importance of the historical background of the veterinary art in China:

The origin of veterinary science may be traced to the period when the wild animals began to be domesticated and became the herdman's livestock. The most ancient domestic animal was cattle. The zebu was already domesticated in Central Asia 7000 years ago. Later the Mongolian tamed the yak in the vicinity of the Altai Mountains. According to inscriptions in the Egyptian pyramids, cattle had been domesticated in 4000 B.C. In China the ox had been domesticated in 3500 B.C. The Mongolian steppe horses were domesticated in 3000-4000 B.C. Swine were domesticated in China 3500 B.C. and were very common in 3000 B.C. The dog is mentioned in ancient Chinese literature as a domestic animal in 3500 B.C. In 2000 B.C. a collection of veterinary drugs had been arranged, but as their number was small it seems doubtful that this list represented the complete veterinary pharmacopeia of that time.

The foregoing is quite in agreement with Chinese historical literature, in which it is repeatedly recorded that Fu-Hsi (2852-2738 B.C.) taught the people fishing and herding, and that Shen-Nung, previously mentioned, trained them to raise livestock for sacrifice and food. Hence, it may be asserted that knowledge of the veterinary art can be traced back beyond five thousand years ago, although some of these records concerning its origin are legendary.

The First Official Veterinarian in China

The appointment of a veterinarian in government service was initiated in the reign of King Chen of the Chou Dynasty about 1120 B.C. According to Chou-Li, in a ritual dealing chiefly with the government organization in that Dynasty, there were, according to this record, four veterinary officials, under a medical supervisor, who were responsible for national veterinary affairs of a civilian nature, and two *fou-ma* (*fou* means a priest who knew the sorcery, *ma* means horse) in charge of the army veterinary service. Their official duties were specified as follows:

1. The *shu-i* is responsible for the curing of animal diseases and wounds. In the treatment of the diseases, medicine should be administered to the animals; they are to be watched as they recover their vitality; and nursed according to the external diagnosis. In the treatment of the wounds, surgical operations should be applied to discharge the malignancy, then relieving them with medicine; and the animals are to be nursed and fed. Each case, whether disease or wound, should be treated. It is necessary to count the deaths so that replacement can be made.

*This paper is abstracted from The Brief History of the Chinese and Western Veterinary Science by the same writer, published in the *Journal of Animal Husbandry and Veterinary Science* (in Chinese), Vol. 2: 197-202, 227-235. 1942. The first part of which is revised to some extent in this version.

2. The *fou-ma* is responsible for taking care of the sick horses. The diseases are to be cured by medicine according to a diagnosis externally.

Thus, animal doctors and horse doctors appear to have been differentiated. Downward to the Tan Dynasty (618-905 A.D.), a golden period of Chinese history, there were four senior veterinarians, 600 veterinarians and 100 veterinary pupils or apprentices, all under the Tai Po Se or the Ministry of Horse Administration. According to the "Official Annal of New Tan History" the veterinarians and apprentices were government employees and provided for by law. In addition, 60 veterinarians were installed in the Bureau of Imperial Driven, which was responsible for supplying vehicles and horses for the imperial family and high officials in the capital. Thus the veterinary service in China was well established 2500 to 2800 years ago.

It took a ten-mule team to pull a heavy Chinese howitzer over mountainous terrain on the Burma Road to the fighting at Yunnan, China. Major Joseph L. Gidley, V.C., Sacramento, Calif., and Captain Richard Shea, V. C., Brawley, Calif., were among those assigned to the Chinese Combat Command who participated in the Yunnan offensive.

Pioneers of Early Veterinary Medicine

In studying the origin of veterinary medicine in China, it may be valuable to recall some important events which occupy a prominent place in world veterinary history in every stage. The most significant veterinary surgery, successfully practiced in remote days, was castration. It was said that an attendant of Hwan-Ti (Yellow King, 2697-2597 B.C.), named Tonfee Chen Zain was the first one to develop the method. Kawada[1] stated: "It is not known about the origin of horse castration in the Occident,[2] but it seems to have been developed in Hwan-Ti's period in China." Kawada also mentions that Gen. Hain Sin, a hero in early Han Dynasty (about 185 B.C.), may have made some improvement in the operation. Further evidence confirms the above statements.

It is well established that castration had long been applied to certain criminals in the Ying Dynasty (1783-1135 B.C.), and that the eunuch also appeared at that time in China.

The man officially recognized, during the monarchial period, as the founder of ancient veterinary medicine in China was Mass Hwan, who lived during the reign of the Yellow King. His life was vividly described in some medical histories and related literatures, although some of the descriptions are extremely mythical. Lee,[3] who recently investigated the temples for worshipping the Chinese medical pioneers, recognized Mass Hwan as one of the 10 distinguished ancient medical pioneers. A similar statement was also made previously by Yoshida.[4] In accordance with the rule of classical proprieties in former Dynasties, an annual grand ceremony in honor of the most eminent medical forebears was held under the auspices of the government. For instance, through an Order of Emperor Chia-Tsing in 1536, as recorded in the Ming history, the Chin-Hwai Temple was rebuilt, wherein there are 21 statues individually representing the most admirable ancient medical men. One of these was Mass Hwan. The Temple is still preserved in Peiping, but this historical ceremony has not been observed for many years.

It seems very appropriate to mention here

1. Kawada, K. Ancient Castration in China and in *Modern Veterinary Medicine* Vol. 26, No. 9. (Japanese).
2. According to George R. White's Animal Castration, third edit. 1947, castration was advocated and practiced as early as seven centuries before the Christian Era.
3. Lee, T. Medical Temples and Ten Famous Doctors. *Chinese Medical Magazine* Vol. 27, No. 2. 1941.
4. Yoshida, M. The Biography of the Famous Doctors in Chinese Dynasties. (Japanese).

one veterinary pioneer, Pai Lo, who may be regarded as the junior founder of ancient veterinary medicine. He was usually known by the pseudonym of Sun Yang. He was at one time a minister of the feudal Chi State (now in Shangton province) during the Chou Dynasty, soon after the Confucious' period. Sun Yang was a very prominent horse fancier. His works, particularly with respect to horse judging, were closely associated with veterinary medicine. He influenced veterinary knowledge a great deal not only in China but also in other far eastern countries. Thus, the veterinarians in Japan were regarded as

Col. D. H. Mallan, V. C. received the Bronze Star Medal for meritorious service with the Chinese Combat Command during 1944.

"Horse Pai Lo" in certain cases. The rules of Pai Lo in judging horses were for the most part very practical, in spite of some old theories which they contain which do not seem to be consistent with the new science. However, they were written more than 25 centuries ago.

Numerous Veterinary Writings Published

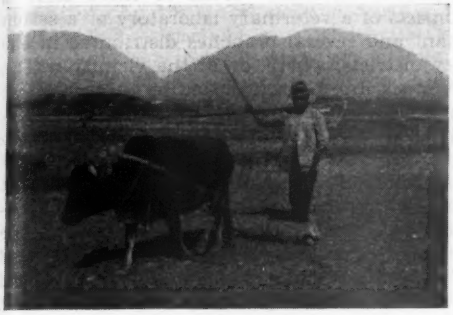
It seems advisable to present a general sketch of veterinary literature published in China many centuries ago. As a matter of fact such writings suggest that a number of veterinary scholars really made some wonderful contributions to this field, especially to the effective application of drugs to the treatment of certain diseases, livestock judging and some surgical operations. A representative list of such writings is appended.

List of Veterinary Writings Published Centuries Ago

Title of Book	*Volumes*	*Author*
1. Classic of Horses	1	Pai Lo (mentioned previously)
2. Therapeutics for Horses	4	Pai Lo
3. Therapeutics for Miscellaneous Diseases of Horses	1	Unknown
4. Sheep Keeping	1	Pow Seh (about 110 B.C.)
5. Swine Keeping	1	Pow Seh
6. Livestock Keeping	1	Chia Se-Yai (about 560 A.D.)
7. Therapeutics for Horses, Cattle, Camels and Mule Diseases	2	Unknown
8. New Compiled Horse Book	1	Unknown
9. Therapeutics for Horses	3	Yue Chi
The books 7 to 9 were published before the Sui Dynasty (589-617 A.D.) according to the "Art Annul of Sui History".		
10. Horse Judging	2	Chu Chen
11. Horse Judging	6	Chukga Yieng
12. Cattle Judging	1	Nin Chi
The books 10 to 12 were published in the Tan Dynasty (618-905 A.D.) according to the "Art Annul of New Tan History".		
13. Book of Cattle	1	Chia Po
14. Farm Cattle Book	1	Tin Tu
15. Stud Management and Horse Keeping Including Selected Prescriptions	3	Lee Se
16. Chao-San Revised Collection of Prescriptions for Horses	1	Official publication of the Soon Dynasty
17. Illustrations for Horse Judging	1	" "
18. Book of Camels	1	" "
19. Therapeutics for Camels	2	" "
The books 13 to 19 were published in the Soon Dynasty (960-1276 A.D.) according to the "Art Annul of Soon Dynasty".		
20. Farm Animal Management (in Compendium of Agriculture and Sericulture)	1	Official publication of the Yuan Dynasty
21. Horse Book for Stud Management and Therapeutics	6	Official publication of the Ming Dynasty
22. Book of Water Buffalo	3	Tan Chao-Fow
23. Collection of Horse Therapeutics, Including Cattle and Camels	5	Yue Brothers
24. Livestock Keeping	1	Chu Kwan-Tsi
25. Compiled Prescriptions for Frontier Animals	1	Official publication in early Chin Dynasty
26. Prescriptions for Camels	1	" "
27. Collection of the Prescriptions for Falcon and Other Hunting Birds	1	" "
The books 21 to 27 were first printed in Ming Dynasty (1368-1643 A.D.) according to the "Bibliography of the Collection of Four Libraries".		

In addition to these, there were about 20 different works printed before the Ming Dy-

nasty, which primarily dealt with horses and cattle, also poultry. The most popular among them was written by Yue brothers, which was largely compiled from the writings of earlier authors on veterinary medicine and animal husbandry. This book, to the present day, still



A CHINESE "TRACTOR"

retains its value as a chief guide for the traditional veterinarians who are not college trained. However, most modern veterinarians consider it to be unscientific, although it and others contain much data worthy of scientific investigation.

When Did the New Veterinary Education Commence?

Why did veterinary medicine, and indeed all science, develop so early in China and then fall so far behind western science? One cause may be that in the main during the monarchial period, literature and classic studies were considered of greater value than science. As a consequence veterinary medicine not only did not advance, but actually lost ground. Thus, before the new veterinary education was put into practice, veterinary practitioners, except for a few scholars, were mostly livestock dealers, horse shoers or blacksmiths as you say in English, and family-inherited veterinarians, who were generally of low social reputation, just as in western civilization the art of surgery was relegated to the barber-surgeons a few centuries ago. About 45 years ago one might say that a new epoch of Chinese veterinary history began, for then the new veterinary education was introduced.

No data can be obtained to indicate the extent of scholastic education in veterinary medicine during the early dynasties, though medical schools[5] were already established in the Tan Dynasty. But as stated previously, there were four senior veterinarians under the Ministry of Horse administrations who were responsible for training the students or the candidates for veterinary appointments. This might indicate that some measure of veterinary training was carried on centuries ago.

The first modern veterinary school, originally named Pei Yang Veterinary School, was established at Paoting, Capital of Hopei province, in 1904, and under the direct supervision of the North-China Viceroy's Headquarters. Later it was moved to Peiping and organized as the Army Veterinary School.[7] Ten years ago this magazine[6] gave the following information, wherein it was mentioned that veterinary education in China is classified into (1) traditional and (2) modern; that there are three centers of veterinary education: (1) Army Veterinary School, whose 500 graduates constitute the entire body of Army veterinarians and part of the meat inspection force in public institutions, (2) the Department of Animal Husbandry and Veterinary Medicine[8] of the Agricultural School of National Central University, organized in 1929, the students of which engaged mainly in teaching, (3) the Veterinary School at Shanghai, which was opened in 1932 to train young men for meat inspection and for the control of epizootics.

A number of such veterinary institutions were successively formed subsequent to the above three. Kiansi Provincial Veterinary School was established in 1937, and Northwest Veterinary College at Langchow was opened in 1947. Recently a department of veterinary medicine or a combination of veterinary medicine with Animal Husbandry required in many agricultural colleges, such as those in Chunshang University at Canton, Kwansi University at Liuchow, Taiwan University at Taipei, Peiking University at Peiping, Jinshih University at Chinghwa, Northwest Agricultural College at Wuckong, and others. In Manchuria, there are two important veterinary schools at Mukden and Chanchung. Unfortunately, the civil war makes the latter two inactive.

After Modern Veterinary Medicine was Put Into Practice

The manufacture of veterinary biological products and the creation of epizootic prevention organizations, which were already fairly well carried out prior to the outbreak of the Sino-Japanese War, may indicate that Chinese veterinary workers had performed their duty successfully under very arduous circumstances in some parts of China. Though modern veterinary education has been developed only a

5. Wang, K. C. and Wu, L. T. History of Chinese Medicine. 1932. (In English). Tientsin.

6. Veterinary Service in China; *Vet. Med.* 32:12, pp. 546-547. (December) 1937.

7. The Army Veterinary School is reorganized recently as the Veterinary College of National Defense Ministry. As consequence of the suggestion of the U. S. Military Adviser Group in Nanking both the fundamental veterinary education and Army Veterinary Service training are separately carried out in the College.

8. The Department of Veterinary Medicine was formed in 1946.

few decades, the number of qualified technicians is actually insufficient, and the majority of people do not appreciate the importance of the veterinary service. Mallein was the first biological product prepared. It was followed

Captain Thomas J. Guilfoil, now practicing in Seattle, Washington, receiving instructions on present veterinary customs from a native while he was assigned to the Chinese Combat Command during the late war.

by rabies vaccine, manufactured by the Central Epidemic Prevention Service at Peiping, in 1924. Immediately following these the sera for rinderpest, anthrax, hog plague, hemorrhagic septicamia, chicken cholera and various vaccines for the preceding and other epizootics were supplied by the serum plant of the Seaport Goods Inspection Bureau at Tsingtao and other veterinary laboratories. All sera and vaccines were produced, but the amount was far inadequate to meet the demands. Among these laboratories the Kwansi Provincial Livestock Welfare Bureau[9], founded in 1933, may represent the others except that at Tsingtao, However, this well equipped laboratory was severely damaged during the Japanese invasion in Kwansi.

A National Epizootic Prevention Measure was promulgated by the Executive Yuan in 1936, in which it is emphasized that the rule of the quarantine should be strictly put into operation to prevent the invasion of some infectious diseases especially bovine tuberculosis, foot-and-mouth disease, and some tropical diseases, which were not indigenous to China years ago. In order to bring about the nation-wide epizootic prevention project, in addition to the veterinary laboratory of the Central Research Bureau of Livestock Industry, which was already founded at Nanking in 1935, there are three main epizootic prevention services, each being separately responsible for controlling principally the diseases of farm animals in the Northwest, Southwest, and Southeast areas. Two such organizations were added for Mancruhia and North-China areas after the Japanese surrender. Each of these services consists of a veterinary laboratory or a serum plant and several branches distributed in the key districts, where, or in the vicinity where, livestock are often attacked by these horrible epizootics especially the rinderpest and hog cholera. Two laboratories worthy of mention here are the Epizootic Research Department and the Equine Epizootic Research Department in the Continent Science Institute at Chanchung conducted by the Japanese during the Japanese occupation of Manchuria. It is said that the important equipment was all looted before the Chinese government took them over.

With regard to the army veterinary service approximately 45% of the army veterinarians graduated from the Army Veterinary School and 35% of them have had short-course training at the same institution; 5% are from other schools. The remainder, about 5%, are the above-mentioned traditional veterinarians, who as a rule perform the old fashioned curing art and use the native plant drugs instead of the expensive chemicals. To supply the veterinary biological products for the military animals another serum plant was set up at the beginning of the Japanese War.

The following remarkable events are intimately associated with the improvement of recent veterinary science in China: (1) Veterinary experts came from abroad to help us improve veterinary education and veterinary service. Japanese and German professors were engaged in teaching in the Army Veterinary School 30 years and 10 years ago respectively. Later, American veterinary experts were sent to China for the war effort. (2) Students were sent or encouraged to go oversea to study veterinary medicine. Six students were chosen to study in Japan early in 1906 by the Army Ministry. Recently a considerable number of veterinary graduates come to the United States. Estimating roughly, about 50 Chinese veterinarians were graduated or are studying in the U. S., 35 were graduated in Japan, five in Russia, three in France, two in England, two in Germany, and some in other countries. (3) Participation in the International Veterinary Congress, when the tenth and eleventh congresses were held in London in 1914 and 1930. The Chinese government sponsored the delegates.

9. Rodier, E. A. Organizing a Bureau of Animal Welfare for Kwansi Province, Southwest China. *Vet. Med.* 37: 10, pp. 451-452. 1937.

Casualty Losses Are Deductible in Income Tax Returns

By HAROLD J. ASHE
Tax Counselor

MANY taxpayers continue to overlook deducting losses sustained by destruction of property by fire, storm, flood or other casualty. This is especially true where the destruction is only partial, and the damage is repaired and forgotten by the time the annual income tax return is made. Yet, such loss is as real and substantial, where incurred, as though a safe cracker had stolen a like amount from the strong box. Even more commonly overlooked than casualties to business property is that to non-business property, and also tax deductible.

Pointing this up is the recent disastrous flood in the northwest, only a fraction of which loss will be reflected in 1948 income tax returns by taxpayers. Less spectacularly, millions of taxpayers suffer casualties every year, ranging from flooded basements, destruction of trees and plantings, by storms, to complete demolition of large business structures by hurricanes, fires and explosions.

It is unwise for the taxpayer who has suffered a casualty loss to trust to memory in getting such a loss into his annual tax return. Moreover, such a slipshod approach, even if the loss is entered in the tax return, may lay the deduction open to question by the Internal Revenue Bureau, and its possible disallowance.

Immediately a loss has been sustained, the taxpayer should start building a record to substantiate the amount of the loss. Particularly where the loss is only partial and, therefore, subject to dispute, it is advisable to have an appraisal of the loss made before the damage is repaired. Secondly, the taxpayer should make a point of keeping repair bills against future challenge.

The general rule applying to deduction where the destruction is complete is that the amount of the deduction shall equal the adjusted basis of the value of the property. That is, the original cost less depreciation since acquisition, and to date of loss.

However, where the loss is only partial, the deduction shall be the value of the property immediately prior to the loss, less the value of the property immediately after the loss. This loss must not exceed the adjusted value.

In both partial and total loss, compensation from insurance must be deducted from the loss to arrive at the unrecovered loss, and the unrecovered loss is the amount deductible in the tax return.

As an example, take the case of a business building partially destroyed by flood in Oregon. Here is how the loss is reckoned for tax purposes:

1. Cost of building in 1936	$25,000
2. Depreciation to date of loss	9,000
3. Maximum deduction allowable	16,000
4. Value before flood	15,000
5. Value after flood	11,000
6. Flood loss	4,000
7. Insurance received	3,250
8. Unrecovered loss	750

As the unrecovered loss is less than the basis (item 3), the taxpayer's deduction is $750, the unrecovered loss.

It should be noted that, while a taxpayer may also deduct for non-business property losses, he may do so only if he uses the long form in which he reports such losses, together with other personal deductions. If he uses the short form or takes the standard deduction for personal deductions he may not additionally deduct for non-business property losses. This circumstances emphasizes the necessity for carefully reviewing the year's casualty losses of a non-business character. Frequently such losses will warrant a taxpayer electing to report his personal deductions instead of using the short form or taking the standard deduction.

The tax payer should not trust to memory in claiming casualty loss, as it may be questioned by the Internal Revenue Bureau.

A partial check list of deductible casualties include:

(a) Fire, including damage to business, home, garage, furniture, automobile, equipment, and other property;
(b) Storm, including damage by rain, flood, lightning, wind, to property;
(c) Earthquake, damage to property;
(d) Explosions, damage to property;
(e) Automobile accidents, damage to property;
(f) Theft of property, personal or business.

Sulfamerazine & Sulfathalidine (Phthalylsulfathiazole) For Enteritis-Pneumonia Syndrome in Swine

By E. V. EDMONDS, D.V.S.
Berkeley, California

THERE are no authentic, available statistical data indicating precisely the number of swine that annually succumb to pneumonia. Observations during the past five years, however, have convinced the writer that some of these losses, whatever their number may be, are preventable and unnecessary. In many instances swine losses can be prevented or reduced to a minimum by proper management practices. In this coastal area the incidence of pneumonia in swine is noticeably greater during certain seasons of the year than it is at other seasons, and it is believed to be influenced to a large degree by climatic conditions. The author has noted, repeatedly, that the number of cases of pneumonia in light weight feeder pigs, ranging from 35 to 75 pounds, often is very high after the animals are transported in open trucks or railroad cars from regions having climates differing from that of the coastal area. This is especially true during the cold rainy season. The relatively low temperature and the frequent presence of dense fog and rainy weather at certain times of the year along the Pacific Ocean coastline must be considered as predisposing causes for pneumonia in swine. Under these conditions pigs are apt to "stack up" in their sleeping quarters when they are delivered to the ranches. This is a management problem and, because of climatic conditions, is not easy to correct.

Both enteritis and pnuemonia are quite common in feeder pigs weighing from 35 to 75 pounds maintained on garbage feeding ranches. Hygienic conditions on these ranches are not entirely satisfactory; however, many owners are gradually improving their facilities.

During the past few years sulfamerazine and sulfathalidine (phthalylsulfathiazole) have been used extensively in experimental studies and clinical investigations for the prevention and treatment of infections in livestock and poultry. These reports [1-30] indicate that when the compounds are properly administered, these drugs are safe and exceedingly useful chemotherapeutic agents. Beneficial results can be expected when they are used in the treatment of a variety of infections.

When sulfamerazine is administered orally a high percentage of it is absorbed rapidly and the compound slowly eliminated from the body.[31] Thus it is indicated in the treatment of systemic infections. Sulfathalidine, on the other hand, is very sparingly absorbed from the gastrointestinal tract; a high percentage remains in the gut and these exerts its therapeutic effect.[32, 33] This compound therefore is indicated for the management of enteric infections.

Because of the high incidence of enteritis and pneumonia in this section, and the favorable reports from many veterinarians who had employed them, the author decided to conduct a series of clinical studies on the effectiveness of sulfamerazine and/or solutions of sodium sulfamerazine as well as sulfathalidine in the treatment of infections in swine. It has been reported previously that sulfathalidine is of value in the treatment of enteritis in swine.[2, 3, 6, 18, 21] This clinical report details results obtained with these new sulfonamides, sulfamerazine and sulfathalidine, separately and together, in the treatment of swine exhibiting the enteritis-penumonia syndrome. Because of the value of feeder pigs, especially during the period covered by these studies, the owners were reluctant to maintain equal numbers of untreated control animals. It was possible, however, to have a few untreated controls in some experiments.

In the beginning of our investigation some of the swine owners were rather hesitant to assist in undertaking treatment for pneumonia in swine, because previous methods and agents employed had failed to produce favorable results. However, after a few successful demonstrations with these sulfonamides the attitude of the ranch operators changed and they were willing to participate in the program since they realized a financial saving by having more marketable animals.

Our early work was conducted with either a single animal or only a few cases in a herd. This was done to determine the value of, and a dosage schedule for, the compounds as well as to induce the ranch operator to co-operate in the experiment. Since these preliminary results invariably were quite encouraging, indifference waned and interest and enthusiasm grew among all the individuals concerned with the problem. In this manner larger groups of animals were made available for study and assistance in doing the work was provided by the owners.

The popular breeds of swine in this territory were represented in this study: Duroc Jersey, Berkshire, Hampshire, Chester White, Poland China, and Hereford. In a majority of the herds, garbage, collected in nearby cities, was

10	7	7 mo.	70 to 80	106.4 to 107.	" "	3 Gm.SMD 8 Gm.STD	1.5 Gm.SMD 4 Gm.STD	1.5 Gm.SMD 4 Gm.STD		3	4	Vesicular exanthema present. Undoubtedly influenced recovery.
11	8	3½ mo.	50 to 60	105.5 to 108	" "	4 Gm.SMD 4 Gm.STD	4 Gm.SMD 4 Gm.STD	4 Gm.SMD 4 Gm.SMD	2 Gm.SMD 2 Gm.STD in drinking water	6	2	Surviving animals observed weekly until they weighed 100 lb. Growth and development was satisfactory.
	1	"	60	106.	" "	NONE					1	
12	8	6 mo.	45 to 60	103.8 to 105.2	Pneumonia	3 Gm.NaSMD	2 Gm.SMD	3 Gm.SMD		6	2	Pneumonia in advanced stage before treatment was given. Survivors made rapid recovery.
13	8	4½ mo.	100	104.8 to 105.5	" "	3 Gm.NaSMD	1½ Gm.SMD	1½ Gm.SMD		6	2	These cases developed in very hot weather.
14	20	2½ mo.	40	104.0 to 105.2	" "	2 Gm.SMD	2 Gm.SMD	2 Gm.SMD		18	2	These animals were in an overcrowded pen.
	10	"	"		" "	NONE					10	
15	20	to 5 mo.	50 to 60	104.5 to 106.	" "	4 Gm.SMD	2 Gm.SMD	2 Gm.SMD		15	5	Pneumonia developed shortly following vaccination against hog cholera with virus and antiserum.
	10	"	" "	"	" "	NONE					10	
16	50	5 to 7 mo.	50 to 80	104.0 to 106.	Enteritis and Pneumonia	4 Gm.SMD 4 Gm.STD	2 Gm.SMD 2 Gm.STD	2 Gm.SMD 2 Gm.STD		45	5	Many animals of about same age and size in this herd not treated succumbed. Most cases developed soon after vaccination against hog cholera with virus and antiserum.
17	50	2 to 2½ mo.	15 to 25	104.2 to 106.	" "	2 Gm.SMD 2 Gm.STD	2 Gm.SMD 2 Gm.STD in drinking water	2 Gm.SMD 2 Gm.STD in drinking water	2 Gm.SMD 2 Gm.STD in drinking water	45	5	Untreated pigs of same age and size in other groups in this herd had a mortality of 80-85% from enteritis and pneumonia
	2	2 yr.	225	---	" "	22.5 Gm.SMD 22.5 Gm.STD in drinking water	22.5 Gm.SMD 22.5 Gm.STD in drinking water	22.5 Gm.SMD 22.5 Gm.STD in drinking water	22.5 Gm.SMD 22.5 Gm.STD in drinking water	2		" "
18	86	4 to 6 wks.	12 to 15	104. to 105.2	Enteritis and Pneumonia	0.5 Gm.SMD 1.0 Gm.STD	0.5 Gm.SMD 1.0 Gm.STD	0.5 Gm.SMD 1.0 Gm.STD	0.5 Gm.SMD 1.0 Gm.STD	80	6	Animals sick for several days before treatment was provided.
19	100	4 to 6 mo.	50 to 75	104.5 to 108.5	" "	4 Gm.SMD 4 Gm.STD	4 Gm.SMD 4 Gm.STD			90	10	Among groups of untreated pigs, same age and size in this herd the mortality was as high as 80-90%.
TOTAL 406 TREATED 380 Untreated 26		4wks to 2yr " " "	12 to 225 lb " " " "	103° -109° " "						334 (88%) -	46 (12%) 26 (100%	

1 - NaSMD = Sodium Sulfamerazine
2 - STD = 'Sulfathalidine' (Phthalylsulfathiazole)
3 - SMD = Sulfamerazine

TABLE 1.—DATA ON SWINE TREATED WITH SULFATHALIDINE (PHTHALYLSULFATHIAZOLE) AND SULFAMERAZINE

Herd No.	Number of Animals	Age (Approx.)	Body wt. Lbs.(approx)	Temperature (Farhenheit)	Diagnosis	Sulfonamide Therapy				Results		Comments
						1st Day	2nd Day	3rd Day	4th Day	Rec.	Died	
1	1	11 mo.	200	106.	Pneumonia	6 Gm.NaSMD(1)	6 Gm. NaSMD	6 Gm.NaSMD		1		Animal showed marked improvement within 24 hrs. Treatment followed by satisfactory recovery.
2	1	5 mo.	50	106.	Enteritis and Pneumonia	3 Gm.NaSMD 4 Gm.STD(2)				1		
	1	5 mo.	50	106.	" "	NONE					1	
3	1	6 mo.	65	105.	Pneumonia	3 Gm.NaSMD	NONE	3 Gm.NaSMD		1		Animal greatly improved in 24 hrs. Relapse on 2nd day retreatment followed by recovery.
4	1	3 mo.	40	109.	Acute Pneumonia	2 Gm.SMD(3) 2 Gm.STD	2 Gm.STD	2 Gm.STD	2 Gm.STD	1		Marked improvement within 24 hrs.
	1	7 mo.	60	106.8	Enteritis and Pneumonia	2 Gm.SMD 4 Gm.STD	2 Gm.STD	2 Gm.STD	2 Gm.STD	1		Condition of animal critical at time treatment was instituted.
5	1	10 mo.	150	105.	Pneumonia	3 Gm.NaSMD				1		Animal sick for 4 days before treatment. Dramatic recovery.
6	1	1 yr.	225	107.	" "	6 Gm.NaSMD (subcut.) 3 Gm.SMD	3 Gm.SMD	3 Gm.SMD	3 Gm.SMD	1		Animal apparently recovered from this attack but succumbed 8 wks. later. Postmortem revealed abscess in lung.
	1	1 yr.	225	105.4	Pneumonia and metritis	6 Gm.NaSMD (subcut.) 3 Gm.SMD	" "				1	
7	1	4 mo.	40	104.8	Enteritis and Pneumonia	4 Gm.SMD				1		Animal sick for 2 days before treatment.
	2	3 mo.	30	105.2	" "	2 Gm.SMD 2 Gm.STD				2		" " "
8	5	9 mo.	110 to 120	104.4 to 105.2	" "	4 Gm.SMD 4 Gm.STD	2 Gm.SMD 2 Gm.STD	2 Gm.SMD 2 Gm.STD	2 Gm.SMD 2 Gm.STD	4	1	Other pigs in this herd with enteritis were treated successfully with 'Sulfathalidine'
9	5	2½ to 4 mo.	25 to 50	104.4 to 105.3	" "	2 Gm.SMD	2 Gm.SMD in drinking water	2 Gm.SMD in drinking water		4	1	Animal that succumbed did not drink medicated water.
	4	"	"	"	" "	NONE					4	
10	7	7 mo.	70 to 80	106.4 to 107.	" "	3 Gm.SMD 8 Gm.STD	1.5 Gm.SMD 4 Gm.STD	1.5 Gm.SMD 4 Gm.STD		3	4	Vesicular exanthema present. Undoubtedly influenced recovery.
	8	3½ mo.	50 to 60	105.5 to 108	" "	4 Gm.SMD 4 Gm.STD	4 Gm.SMD 4 Gm.STD	4 Gm.SMD 4 Gm.SMD	2 Gm.SMD 2 Gm.STD in drinking water	6	2	Surviving animals observed weekly until they weighed 100 lb. Growth and development was satis-

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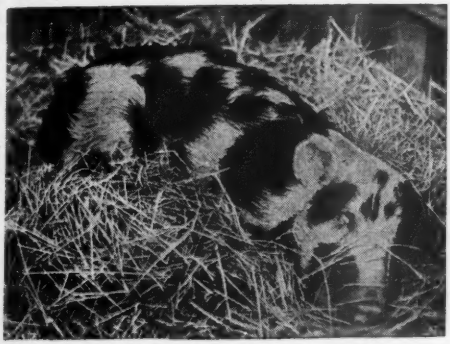
the principal ration of the animals. In a few herds, however, the rations were supplemented with grain, chiefly barley.

The diagnosis of enteritis and/or pneumonia was established by physical examination of the animals. Anorexia, fever, diarrhea, and dypsnea were the main symptoms. Post-mortem examinations were conducted, in most of the herds, on amimals that succumbed. When the diagnosis was established treatment was instituted promptly. Laboratory examination of tissues and cultures were omitted due to the limited facilities available at the time post-mortem examinations were conducted.

In a number of cases enteritis and/or pneumonia developed within seven to 21 days following the vaccination of the animals



against hog cholera with virus and antiserum. Such reactions and complications are common. It is believed that the resistance of the animals to infections is lowered immediately after vaccination and they are quite susceptible to bacteria that can cause enteritis and/or pneumonia. In our observations the enteritis usually preceded pulmonary infection. In previous publications we have reported our success with the use of sulfathalidine in the management of enteric infections. However, it is not always possible to begin treatment early enough to obtain the desired result. This report includes mainly data on animals, which had definite evidence of enteric and/or pulmonary disturbance. In such cases, where fatal, pneumonia usually was the immediate cause of death.

Table I contains information regarding the animals and observations in our clinical studies with the use of sulfathalidine and sulfamerazine as agents for the treatment of the enteritis-pneumonia syndrome in swine. This study included 406 animals in 19 herds.

An analysis of the data shows that, of the 380 animals treated, 334, or 88%, recovered while 46, or 12%, died. In this study there were also four groups, comprising an aggregate of 26 animals, which were maintained as untreated controls. All controls succumbed to a disease condition indistinguishable from that which existed in the larger group that received sulfonamide therapy.

Sulfathalidine and sulfamerazine were given orally and sodium sulfamerazine, 6% solution, was injected either intraperitoneally or, in a few cases, subcutaneously. Medication was given in single daily doses for periods longer than four days.

Prompt and beneficial effect usually was noted when sodium sulfamerazine in solution was administered parenterally in the early stages of the disease. Anorexia in sick animals is a handicap to treatment *via* the feed or water; therefore oral administration of tablets or parenteral therapy is recommended.

The oral medication with sulfathalidine and sulfamerazine was accomplished by using tablets (bolets) containing 4gm of the drug. British capsule forceps and a swine mouth speculum have been safer in our hands, and more effective for giving tablets orally than the conventional balling gun. Many operators apparently injure the pharynx or may deposit the tablet into the pharyngeal recess when the balling gun is used. This is not so apt to happen when the tablet forceps and mouth speculum are used.

In a few cases the drugs were administered in drinking water. In such instances the compounds were dissolved in alkalized water prepared with sodium carbonate (monohydrate). To prepare the alkalized water, one pound of sodium carbonate is dissolved in five gallons of water. The acid form of sulfathalidine and sulfamerazine dissolves rapidly in this solution.

Summary

The results of these clinical studies indicate that sulfathalidine (phthalylsulfathiazole) and sulfamerazine are of definite value in the treatment of the enteritis-pneumonia syndrome in swine.

In this study of 380 animals, most of them between the ages of two and 10 months, and representing 19 different herds, were treated. Three hundred and thirty-four, or 88%, recovered while 46, or 12%, succumbed. In 26 untreated control animals the mortality rate was 100%.

Sodium sulfamerazine was injected intraperitoneally or subcutaneously and the acid forms of sulfamerazine and sulfathalidine were given orally as tablets or in alkalized drinking water.

In view of our observations in these studies we believe that the following dosages can be recommended for the effective use of sulfa-

merazine and sulfathalidine in the treatment of enteritis-pneumonia syndrome in swine: sodium sulfamerazine, 3gm daily per 85-100 pounds of body weight, administered parenterally. Maintenance dose of sulfamerazine was 1gm per 10 pounds of body weight daily for one or two days and then was reduced by 50%.

Sulfathalidine (phthalylsulfathiazole): For the control of enteritis in swine this agent should be given, 1gm per 10 pounds of body weight daily. This dosage should be continued for several days and reduced as the condition improves.

Administration of sulfamerazine and sulfathalidine once daily in the dosage recommended was adequate to overcome the infections that existed in the animals included in this series.

In these studies no evidence of toxicity developed, which was attributable to the two drugs used.

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Incidence of Anthrax in Livestock During 1945, 1946, and 1947 with Special Reference to Control Measures in the Various States

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IN a previous report we reviewed the history of anthrax in livestock in the United States and presented statistical data on its prevalence and distribution from 1915 to 1944. In that report[1] it was pointed out, (1) that outbreaks of a disease believed to be anthrax were recorded in widely separated areas as early as from 1834 to 1889; (2) that four national surveys had been conducted to determine the incidence of the disease in livestock from 1915 to 1944 inclusive; (3) that large areas of infection now exist in seven states and smaller areas in at least seven other states; (4) that from 1915, when outbreaks had been reported from 157 counties in 21 states, there was a gradual increase in the territory involved, so that by 1944 outbreaks had been reported from at least 438 counties in 43 states. Of the five states — namely, Arizona, Indiana, Maine, Michigan, and West Virginia — that failed to report outbreaks during that period, it has since been ascertained that outbreaks occurred in Arizona in 1931 and in Indiana in 1923 and, according to Smyth,[2, 3] that possibly animal anthrax has occurred in Maine and West Virginia also.

Purpose of Survey

Since anthrax is one of the most serious diseases with which livestock sanitary officials have to contend, and because of its importance from both an economic and public health standpoint, it appears highly desirable to have up-to-date, authentic vital statistics available on its occurrence in livestock in all sections of the United States.

From 1945 to 1947 inclusive, reports were received by the Bureau from different sources, indicating that anthrax outbreaks had occurred in a number of different areas. In order to obtain more definite data on the actual occurrence of these outbreaks, their location, extent of losses, and measures adopted for control, a questionnaire was sent to each Bureau inspector in charge of field work in the various states with instructions to furnish the requested information, after consultation with the state livestock sanitary officials. The data on the national incidence of the disease in livestock for the calendar years 1945, 1946, and 1947 and other statistical material presented in this report are based for the most part on the information contained in the completed questionnaires.

Owing to the difficulty of obtaining complete information on anthrax from all the states, the data contained in this report cannot be considered 100% accurate. For example, some of the states furnished estimated figures in lieu of accurate data on the number of outbreaks and losses in livestock. However, we believe the data set forth in this report represent a comprehensive picture of the national incidence of the disease in livestock for the three-year period, 1945-1947.

To give a general picture of the geographic prevalence of the disease, a map of the United States showing the number of outbreaks reported from each state from 1945 to 1947 inclusive and the location of the counties in which the outbreaks occurred is included in this report. Also included are Table I, which gives the states reporting outbreaks, the number of outbreaks by states, the number of counties involved and the losses of livestock for each of the three years, and Table II, which gives a list of the states that failed to report outbreaks from 1945 to 1947, with the date of the last reported outbreak.

Occurrence of the Disease in Animals and Man

The data compiled from the questionnaires, mentioned in the foregoing, indicate that during the three-year period from 1945 to 1947 inclusive, 384 anthrax outbreaks in livestock were reported from 29 states involving 157 counties with a total loss of 3,720 cattle, 1,298 horses and mules, 154 sheep, and 310 swine. During 1945, 97 outbreaks were reported from 14 states, involving 52 counties with a total loss of 484 cattle, 13 horses and mules, 14 sheep, and 72 swine. During 1946, 163 outbreaks were reported from 18 states involving 82 counties with a total loss of 2,665 cattle, 1,230 horses and mules, and 124 swine. During 1947, 124 outbreaks were reported from 19 states involving 65 counties with a total loss of 571 cattle, 55 horses and mules, 140 sheep, and 114 swine.

Table I shows that most of the outbreaks occurred in cattle. In some areas heavy losses occurred in horses and mules, and fairly heavy losses in swine. Only one state — California — reported outbreaks in sheep. These records substantiate the statement made in a previous report[1] that anthrax in the United

*Pathological Division, Bureau of Animal Industry, Agricultural Research Administration, U. S. Department of Agriculture.

TABLE I.—STATES REPORTING ANTHRAX OUTBREAKS IN LIVESTOCK FROM 1945 TO 1947 INCLUSIVE, AND DATA ON THE INCIDENCE OF THE DISEASE

State	1945							1946							1947							Total for Three Years						
	Reported	No. Counties	No. Outbreaks	Livestock Losses: Cattle	Horses & Mules	Swine	Sheep	Reported	No. Counties	No. Outbreaks	Livestock Losses: Cattle	Horses & Mules	Swine	Sheep	Reported	No. Counties	No. Outbreaks	Livestock Losses: Cattle	Horses & Mules	Swine	Sheep	Reported	No. Counties	No. Outbreaks	Livestock Losses: Cattle	Horses & Mules	Swine	Sheep
ALA.	Yes	1	1	3	0	0	0	Yes	1	1	1	0	0	0	No	0	0	0	0	0	0	Yes	2	2	4	0	0	0
ARK.	No	0	0	0	0	0	0	No	0	0	0	0	0	0	Yes	9	20	50	10	0	0	Yes	9	20	50	10	0	0
CALIF.	Yes	15	47	146	2	8	14	Yes	13	38	233	2	4	0	Yes	12	31	115	0	4	140	Yes	26	116	494	4	16	154
COLO.	Yes	1	1	8	0	0	0	Yes	2	2	40	0	5	0	No	0	0	0	0	0	0	Yes	3	3	48	0	5	0
ILL.	No	0	0	0	0	0	0	Yes	2	2	5	0	10	0	Yes	1	1	1	0	0	0	Yes	3	3	6	0	10	0 ***
IOWA	No	0	0	0	0	0	0	Yes	1	1	1	0	0	0	No	0	0	0	0	0	0	Yes	1	1	1	0	0	0
KANS.	Yes	1	1	5	0	0	0	No	0	0	0	0	0	0	No	0	0	0	0	0	0	Yes	1	1	5	0	0	0
KY.	No	0	0	0	0	0	0	No	0	0	0	0	0	0	Yes	2	4	13	22	0	0	Yes	2	4	13	22	0	0
LA.	No	0	0	0	0	0	0	Yes	13	1*	1800	1200	0	0	No	0	0	0	0	0	0	Yes	13	1*	1800	1200	0	0
MD.	No	0	0	0	0	0	0	Yes	1	1	1	0	0	0	No	0	0	0	0	0	0	Yes	1	1	1	0	0	0
MASS.	No	0	0	0	0	0	0	No	0	0	0	0	0	0	Yes	1	1	7	0	0	0	Yes	1	1	7	0	0	0
MINN.	Yes	1	10	13	0	0	0	No	0	0	0	0	0	0	Yes	1	1	3	0	0	0	Yes	2	11	16	0	0	0
MISS.	Yes	7	7	35	0	0	0	Yes	9	9	66	0	0	0	Yes	4	4	52	0	0	0	Yes	12	20	153	0	0	0
MO.	Yes	1	3	12	4	14	0	Yes	5	48	157	22	60	0	Yes	3	24	18	20	75	0	Yes	6	75	187	46	149	0
NEBR.	Yes	3	3	4	0	30	0	Yes	3	3	3	0	12	0	Yes	4	4	5	0	10	0	Yes	8	10	*12	0	52	0 ***
NEV.	Yes	1	1	6	0	0	0	Yes	2	2	12	0	0	0	Yes	1	2	26	0	0	0	Yes	3	5	44	0	0	0
N. MEX.	Yes	1	1	14	0	0	0	Yes	1	1	21	0	0	0	No	0	0	0	0	0	0	Yes	1	2	35	0	0	0
N. Y.	Yes	1	1	1	0	0	0	Yes	1	3	3	0	0	0	Yes	2	4	4	0	0	0	Yes	4	8	8	0	0	0
N. C.	No	0	0	0	0	0	0	Yes	1	1	1	0	0	0	No	0	0	0	0	0	0	Yes	1	1	1	0	0	0
N.DAK.	Yes	2	2	28	0	0	0	No	0	0	0	0	0	0	No	0	0	0	0	0	0	Yes	2	2	28	0	0	0
OKLA.	No	0	0	0	0	0	0	No	0	0	0	0	0	0	Yes	1	1	28	0	0	0	Yes	1	1	28	0	0	0
OREG.	No	0	0	0	0	0	0	No	0	0	0	0	0	0	Yes	1	1	6	0	0	0	Yes	1	1	6	0	0	0
PA.	No	0	0	0	0	0	0	Yes	1	1	2	0	0	0	Yes	1	1	3**	0	0	0	Yes	2	2	5	0	0	0 **
S.DAK.	Yes	10	12	20	0	12	0	Yes	15	29	50	0	30	0	Yes	8	8	15	0	15	0	Yes	24	49	85	0	57	0 ***
TEX.	Yes	7	7	189	7	8	0	Yes	10	19	268	6	3	0	Yes	11	14	220	3	10	0	Yes	24	40	677	16	21	0 ***
UTAH	No	0	0	0	0	0	0	Yes	1	1	1	0	0	0	No	0	0	0	0	0	0	Yes	1	1	1	0	0	0
VA.	No	0	0	0	0	0	0	No	0	0	0	0	0	0	Yes	1	1	3	0	0	0	Yes	1	1	3	0	0	0
WASH.	No	0	0	0	0	0	0	No	0	0	0	0	0	0	Yes	1	1	1	0	0	0	Yes	1	1	1	0	0	0
WIS.	No	0	0	0	0	0	0	No	0	0	0	0	0	0	Yes	1	1	1	0	0	0	Yes	1	1	1	0	0	0

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States is primarily a disease of cattle and rarely occurs primarily as a disease of horses, sheep, or swine, the exceptions in horses and sheep being in those areas where large numbers of these animals are maintained. In swine the exceptions are due principally to contaminated feed consumed only by swine.

From 1945 to 1947 one outbreak in buffaloes was reported from Pennsylvania[6] in the Highland Park Zoological Gardens at Pittsburgh. Three buffaloes died during the outbreak and the diagnosis was confirmed by laboratory examination. The source of the infection was not determined. During a severe outbreak of anthrax in northern Missouri in 1946, at least three dogs were reported to have contracted the disease from feeding on the carcasses of animals dead of anthrax.

During this period at least 18 cases of anthrax of agricultural origin occurred in man from direct contact with the carcasses of animals dead of the disease. Seven cases were reported from Arkansas, four from California, four from Louisiana, two from Texas, and one from Oklahoma. While most of these cases occurred in agricultural workers from skinning or handling dead animals, five occurred in veterinarians from performing post-mortem examinations to determine the cause of death.

TABLE II.—STATES NOT REPORTING ANTHRAX OUTBREAKS IN LIVESTOCK FROM 1945 TO 1947 INCLUSIVE

State	*Year of Last Outbreak*	
Arizona	1931	
Connecticut	1925	
Delaware	1939	
Florida	1938	
Georgia	1941	
Idaho	1940	(4)
Indiana	1923	
Maine	——	*
Michigan	——	**
Montana	1944	
New Hampshire	1921	
New Jersey	1943	
Ohio	1921	
Rhode Island	1923	
South Carolina	1944	
Tennessee	1942	(5)
Vermont	1943	
West Virginia	——	*
Wyoming	1933	

In this connection, most of the anthrax cases occurring in man in the United States from 1945 to 1947 were of industrial, rather than agricultural origin. Industrial anthrax occurs in persons engaged in the processing of wool, hair, hides, and other products of animal origin, in industrial plants located principally in some of the New England states, New York, New Jersey, and Pennsylvania.

For example, the anthrax cases in man, listed from 1945 to 1947, in the yearly morbidity record of the U. S. Public Health Reports,[7] show 44 cases for 1945, 36 cases for 1946, and 71 cases for 1947. Of the total 151 cases reported for this three-year period, 123 cases were reported from the areas mentioned in the preceding paragraph. Only 28 cases, some of which no doubt were of industrial origin, were reported from all other states.

A number of cases of agricultural anthrax in man have been reported in which the diagnosis was made in man before it was established in the animals that constituted the source of the infection. Wyatt and Epstein[8] reported three such cases in man during recent years in connection with outbreaks in dairy herds in Wisconsin.

Type and Occurrence of Outbreaks

Most of the outbreaks, that were reported from 1945 to 1947 inclusive, were small, sporadic outbreaks resulting in minor losses. However, during this period one or more sharp outbreaks, involving considerable losses, occurred in Arkansas, California, Colorado, Kentucky, Missouri, Nevada, Oklahoma, and Texas.

Only one major outbreak was reported. This widespread, severe outbreak occurred in Louisiana during the summer of 1946 and involved numerous premises in 13 counties in the northern part of the State, in an area where extensive outbreaks of this nature had not previously occurred. During this outbreak it was reported that 1800 cattle and 1200 horses died of anthrax and at least four cases in man occurred from direct contact with the carcasses of animals dead of the disease. According to Heeren[9] the incidence of human anthrax in Louisiana is comparatively high, 111 cases being reported from 1920 to 1945. Most of these cases occurred during the summer when the prevalence of the disease in livestock is greatest, and in areas where outbreaks occurred in animals.

In this connection, anthrax has existed in Louisiana since its early settlement by the French. Anthrax outbreaks have been reported from all the counties in the State except three. Severe epizootics of the disease in domestic animals are recorded as having occurred between 1834 and 1850, 1895 and 1902, 1920 and 1925, and in 1943.

With few exceptions outbreaks from 1945 to 1947 occurred principally in areas long

*Although anthrax outbreaks in livestock have never been reported from Maine and West Virginia, Smyth (2) has reported evidence that indicates that anthrax in animals may have occurred in both of these states.

**Anthrax outbreaks in livestock have never been reported from Michigan.

recognized as anthrax districts and on farms where the owners had neglected to immunize their livestock against the disease.

In some instances outbreaks occurred in apparently infected areas, where the disease had been quiescent for long periods and where no other source of infection could be determined. The outbreak in Lake County, Illinois in 1946, where the last outbreak was reported to have occurred 30 years previously, and the occurrence of the disease in cattle on an infected farm in Wallington County, Oregon in 1947, which was 16 years subsequent to the last previous outbreak, are good examples of the recurrence of the disease in such areas and the apparent persistence of the infection in the soil.

Outbreaks in new areas were reported from one county in Colorado, Kansas, Oklahoma, North Dakota, and Pennsylvania, from two counties in Arkansas, Kentucky, and Illinois, from three counties in Missouri, from four counties in Mississippi, from 10 counties in Louisiana, and from 12 counties in Texas. The source of the infection in most of the outbreaks in new areas was not definitely determined. For instance, in the outbreak in Thomas County, Kansas, possibilities suggested were (1) the pasturing of cattle on old eroded buffalo wallows, over which was an extensive prairie dog town and (2) fence posts which probably originated in Louisiana. The inference here is that anthrax occurred in bison on the western plains and that the fence posts from Louisiana may have originated in badly infected areas in that State.

Anthrax Field Survey in Nebraska and South Dakota

In the spring of 1946 the writer made a field survey of the anthrax area in northeastern Nebraska and southeastern South Dakota to obtain first-hand information concerning the anthrax problem in that area.

Hearsay evidence indicates that anthrax has probably existed in this area since the time that buffaloes roamed the prairies. Heavy losses are recorded as having occurred in cattle of the early pioneers who moved their cattle from infected pastures along the river bottoms to higher land, as did the Children of Israel during the Fifth Plague in Egypt. It is now believed that anthrax may have been the cause of such losses of the early pioneers in the plains states.

Annual outbreaks of anthrax have occurred in this area for more than 50 years and during this time there have been disastrous, widespread outbreaks at irregular intervals. Such outbreaks are recorded in South Dakota in 1907, 1908, 1912, 1923, 1926, 1932, and 1937. During this period the disease spread from the original focus of infection along the river bottoms in the southeastern part of the State into new areas until 1932, when a widespread, severe outbreak occurred, causing heavy cattle losses and involving most of South Dakota and the northeastern section of Nebraska. For a few years following this outbreak, preseasonal, preventive vaccination was carried out on a large scale and the number of outbreaks was greatly reduced, but in 1937 the most virulent outbreak, with the heaviest losses in the history of anthrax in this area, occurred. An aggressive program for control of the disease was inaugurated following this outbreak. This program, which includes annual, preseasonal vaccination of cattle on infected farms, together with strict quarantine measures and proper disposal of anthrax carcasses, has reduced the incidence greatly in South Dakota and Nebraska.

Table III, which gives the number of outbreaks in South Dakota and Nebraska from 1937 to 1947 inclusive, shows a marked reduction in outbreaks in the two states during this period. South Dakota reported 1,079 outbreaks in 1937 and only eight outbreaks in 1947, and Nebraska reported 462 outbreaks in 1937 and only four in 1947.

TABLE III — ANTHRAX OUTBREAKS REPORTED IN SOUTH DAKOTA AND NEBRASKA FROM 1937 TO 1947 INCLUSIVE

Year	*Outbreaks in South Dakota*	*Outbreaks in Nebraska*
1937	1079	462
1938	110	20
1939	107	25
1940	128	27
1941	152	17
1942	61	3
1943	38	5
1944	37	8
1945	11	2
1946	28	3
1947	8	4

During this survey practicing veterinarians, state and federal veterinarians, as well as livestock sanitary officials, were questioned concerning their views on the prevention, control, and spread of anthrax. The following facts were obtained: Most of the veterinarians were of the opinion that intradermal spore vaccine is the most effective type ever used in this area for the control of anthrax. Intradermal spore vaccine No. 2, 3, or 4 is used principally in this section for annual, preseasonal immunization by most veterinarians, who vaccinate thousands of cattle yearly with excellent results. In addition, several thousand cattle are vaccinated yearly by ranch owners, who use mostly single injection

spore vaccine of different types, and of No. 2 or No. 3 strength, subcutaneously. Several thousand cattle on the Indian reservations in South Dakota are also vaccinated yearly under government supervision. These cattle are vaccinated intradermally by Bureau of Animal Industry veterinarians in the spring, usually in March, April, and May. From 1939 to 1947 inclusive, 67,832 Indian owned cattle were vaccinated with a loss of only 16 animals. It is believed that the vaccination of these cattle has prevented the occurrence of the disease and its spread to adjacent areas.

In this anthrax district, as a rule, only cattle are vaccinated annualy with spore vaccines. Sheep, horses, and mules are vaccinated only when danger of exposure is imminent. Some veterinarians reported good results from the use of intradermal spore vaccine in the face of outbreaks. Losses stopped in five to six days after injection of the vaccine. Anthrax antiserum, No. 4 spore vaccine, and bacterins are also used for this purpose.

In this section, anthrax is a disease principally, of cattle, but swine, horses, mules, sheep, goats, and dogs in about the order mentioned are also affected. A number of cases, some of which were fatal, were reported in man as a result of handling or skinning the carcasses of animals, dead of the disease.

Most of the veterinarians were of the opinion that weather conditions, floods, improper disposal of anthrax carcasses, flies, dogs, crows, buzzards, and the soil are concerned with the occurrence and spread of the disease. Many considered that biting flies play a very important role in the spread of the disease in cattle and are responsible for widely scattered outbreaks during epidemics. It was also pointed out that, while the infection in swine was due in most cases to feeding on anthrax carcasses, the disease was also transmitted to swine by bites on the ears by infected flies, by rooting up of superficially buried anthrax carcasses, and by close grazing on infected soil, especially during the spring.

Some veterinarians also believed that undernourishment and dehydration in range cattle during long, dry, extremely hot periods are contributing factors. Some veterinarians stated that outbreaks of anthrax, for the most part, occur on heavy, gumbo soils and rarely on sandy soil. Others stated that outbreaks also occured on sandy soils, but usually adjacent to low-lying ponds and water holes which were probably the source of infection. Some infected ranches were mentioned where outbreaks have occurred at irregular intervals during the past 15 to 20 years. One infected farm was cited on which the second outbreak occurred 16 years after the first.

The anthrax season in this area, that is, the period when most outbreaks occur, is from July to early September. A wet spring followed by droughts is the season par excellence for anthrax.

Carcasses Condemned for Anthrax on Post-Mortem Inspection at Establishments Operating under Federal Meat Inspection

Records of the federal Meat Inspection Division indicate that 22 cattle were condemned for anthrax (including spore vaccine lesions) from July 1945 to December 1947 inclusive. All of these condemnations were made on animals slaughtered at abattoirs operating under federal inspection in Houston, Texas. During the same period 93 hogs were condemned for anthrax in abattoirs operating under government inspection in Omaha, Nebraska; Sioux City, Iowa; and Sioux Falls and Huron, South Dakota: The records show further, that during this period condemnations for anthrax were greatest in 1946 when 13 cattle and 75 swine were condemned. These condemnations correlate with data collected during the anthrax survey, which indicate that outbreaks of the disease in Texas, Nebraska, and South Dakota were greatest during 1946.

In this connection, previous studies of the condemnation of hogs for anthrax in federally inspected establishments over a period of 14 years indicate that 1,714 carcasses were condemned during that period and that a high percentage of such carcasses were condemned at establishments in Omaha, Sioux City, and Sioux Falls which receive hogs from the anthrax districts of Nebraska and South Dakota. Furthermore, such condemnations usually show a marked increase, following severe outbreaks of the disease in cattle in these areas.

Following an outbreak of anthrax in a herd of swine, the surviving animals apparently make a complete recovery but some of them may continue to harbor a chronic anthrax infection for long periods. When such animals are sent to slaughter, several months after an outbreak, they may appear normal on antemortem inspection, but on post-mortem examination reveal lesions of chronic anthrax in the tonsils and cervical lymph nodes.

Control of Anthrax in the States

The control of anthrax in the states is carried out principally by the livestock sanitary officials and the practicing veterinarians with the cooperation of livestock producers. However, in extreme emergencies when heavy losses from anthrax occur and when the combined forces of state and practicing veterinarians are inadequate to cope with the situation, the Bureau has assisted in the work,

including laboratory examination of specimens from suspected cases of anthrax.

Livestock sanitary laws and regulations for the control of infectious diseases, including anthrax, have been enacted in all the states, but the regulations governing sanitary police measures and the distribution and use of anthrax vaccines differ in many of the states.

In some states, notably Alabama, Maryland, Nebraska, New York, North Dakota, South Dakota, and Virginia, special regulations have been enacted for the specific control of anthrax. In other states the general regulations for the control of infectious diseases, apply also to anthrax. While the laws in most states require that anthrax carcasses and other contaminated material be disposed of by burning or burial in lime, in some states anthrax carcasses must be disposed of within 24 to 48 hours by complete incineration, without skinning, or by deep burial in lime, in a location not subject to overflow.

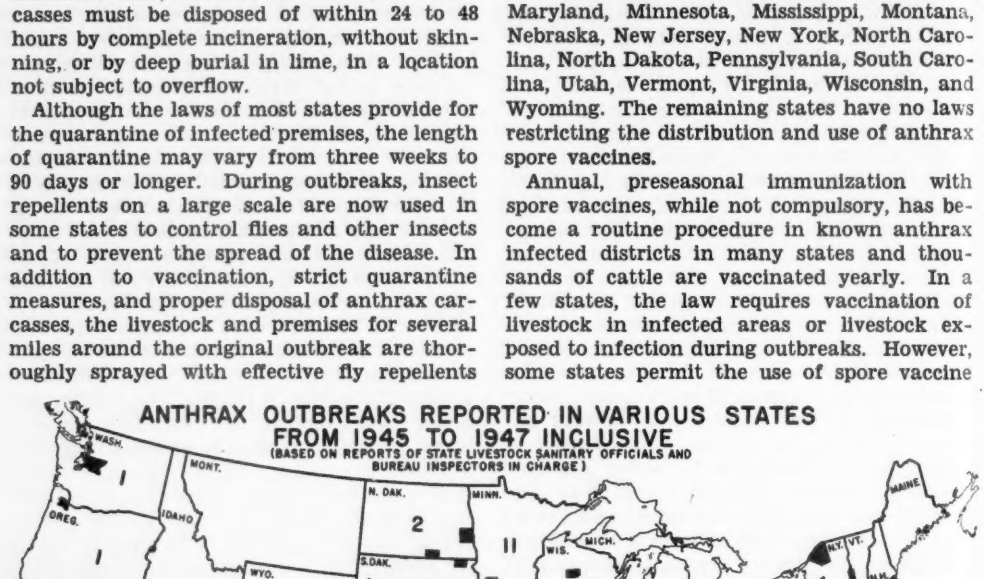
Although the laws of most states provide for the quarantine of infected premises, the length of quarantine may vary from three weeks to 90 days or longer. During outbreaks, insect repellents on a large scale are now used in some states to control flies and other insects and to prevent the spread of the disease. In addition to vaccination, strict quarantine measures, and proper disposal of anthrax carcasses, the livestock and premises for several miles around the original outbreak are thoroughly sprayed with effective fly repellents applied with power sprays. This method was reported to have been used in Arkansas and Oklahoma in 1947 with good results.

To prevent the introduction and spread of anthrax by contaminated bonemeal, at least one state, North Carolina, has a regulation requiring that all ground or crushed bonemeal intended for feeding purposes be heated sufficiently to destroy all anthrax spores.

Laws Covering Distribution and Use of Anthrax Spore Vaccine

Anthrax biological products used in the control of the disease in the United States are produced only by firms holding a United States veterinary license. The following 23 states have specific regulations governing the use of anthrax spore vaccine: Alabama, Arkansas, Colorado, Delaware, Florida, Georgia, Kansas, Maryland, Minnesota, Mississippi, Montana, Nebraska, New Jersey, New York, North Carolina, North Dakota, Pennsylvania, South Carolina, Utah, Vermont, Virginia, Wisconsin, and Wyoming. The remaining states have no laws restricting the distribution and use of anthrax spore vaccines.

Annual, preseasonal immunization with spore vaccines, while not compulsory, has become a routine procedure in known anthrax infected districts in many states and thousands of cattle are vaccinated yearly. In a few states, the law requires vaccination of livestock in infected areas or livestock exposed to infection during outbreaks. However, some states permit the use of spore vaccine



only during outbreaks, and at least two states —Minnesota and Wisconsin—prohibit their use, permitting the use of only anthrax antiserum and anthrax bacterins.

Educational Activities for Control of Anthrax

The livestock sanitary officials and livestock sanitary associations in recognized anthrax areas have conducted an active educational campaign during the past several years for better control of the disease. They have emphasized the value of annual, preseasonal vaccination for prevention and stressed the importance of strict quarantine, proper carcass disposal, and the full cooperation of livestock owners.

In at least four states—South Dakota, Nebraska, Nevada, and Louisiana—an annual reminder is mailed to livestock owners in infected areas early in the year urging that livestock be vaccinated before being turned on pasture or before the advent of hot weather. Other suggestions for the control of the disease, including proper carcass disposal, sanitary precautions, and quarantine measures, are described in these circular letters.

Similar information on anthrax and its control is given in the annual reports of state livestock sanitary officials. During the Mid-Western Seven State Conference of livestock sanitary officials in Sioux City, Iowa May 23, 1946, an anthrax study committee of nine was appointed, by the conference, to study the anthrax situation in that locality and to help develop better means of controlling the disease. The livestock sanitary committee of Sioux City, has given special attention to this subject and published considerable information on the prevalence, prevention, and control of anthrax. A pamphlet entitled "Anthrax Control in Northwest" sponsored by this committee and approved by the anthrax study committee was circulated widely among livestock producers in South Dakota, Nebraska, Minnesota, and Iowa.

The active educational campaign of livestock sanitary officials in recognized anthrax areas in recent years has resulted in large scale preventive vaccination and better cooperation from the livestock owners in the control of the disease which in turn has reduced losses from the disease in livestock and decreased the incidence of agricultural anthrax in man.

A national survey to determine the prevalence and distribution of anthrax in livestock from 1945 to 1947, inclusive, indicates that:

1. During this three-year period 384 anthrax outbreaks were reported from 29 states involving 157 counties.

2. Total losses of livestock from anthrax were as follows: 3,720 cattle, 1,298 horses and mules, 310 swine, and 154 sheep.

3. Eighteen cases of agricultural anthrax occurred in man from direct contact with carcasses of animals dead of the disease. Five of the cases reported were in veterinarians.

4. One outbreak occurred in animals in captivity in a zoological park resulting in the death of three buffaloes.

5. While most of the outbreaks reported were of sporadic nature, at least one widespread virulent outbreak occurred in Louisiana and eight other states reported sharp outbreaks.

6. Most of the outbreaks occurred in areas long recognized as anthrax districts and on farms where owners had neglected to immunize livestock against the disease.

7. Outbreaks in new areas were reported from 12 states involving 40 counties.

8. At establishments operating under federal meat inspection, 22 cattle and 93 hogs were condemned for anthrax.

9. The occurrence of the disease in the anthrax areas of Nebraska and South Dakota has been greatly reduced by annual, preseasonal, prophylactic vaccination of cattle, together with strict sanitary police measures. Veterinarians in this area who vaccinate thousands of cattle yearly, have obtained excellent results with intradermal spore vaccine No. 2, 3, or 4.

Acknowledgment

The author acknowledges with gratitude the splendid cooperation of state livestock sanitary officials in furnishing the Bureau with data on anthrax outbreaks occurring from 1945 to 1947. The writer is indebted to Herbert Rogers, Pathological Division, for assistance in plotting the anthrax map.

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Sulfamethazine Blood Concentrations in Sheep

By MARK WELSH, D.V.M.
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IT has been established that optimum effectiveness of sulfonamide treatment of disease depends upon the maintenance of maximum concentrations of the drug in blood and tissues.[1] It has also been shown that different sulfonamides react differently in the various species of animals.[2, 3] In the latter study,[3] it was demonstrated that sulfamethazine and sulfamerazine generally produced the highest and most persistent blood concentrations, and that sulfamethazine maintained higher blood concentrations for a longer time than the other sulfonamides tested. The results of this work in sheep [3] are shown in Figure 1.

A comprehensive study of sulfamethazine blood concentrations in various species of animals was carried out to provide the veterinarian with a guide for setting up a suitable dosage schedule for treatment. In each species, the drug was administered by various routes and at various dosages, and blood concentrations obtained were presented in graphic form.[4-10] The present report shows sulfamethazine blood concentrations in sheep.

Procedure

Two experiments were instituted to determine blood concentrations of sulfamethazine obtained by parenteral and oral administration once daily. Normal sheep, approximately three to four months of age, were used. The drug was administered subcutaneously to two sheep, and orally, to four. The dosage used was 1.5 grains per pound of body weight on the first day and one grain per pound on the second and third days. The drug was given once daily. For parenteral administration, sodium sulfamethazine 25% weight-volume, sterile solution was used. Sulfamethazine powder was placed in gelatin capsules for oral dosing. Blood samples were taken one hour following the initial drug administration, and at 4, 8, 12, and 24 hours on each day of the tests. Sulfonamide determinations were made according to a modification [3] of the Bratton-Marshall method.[11]

Discussion

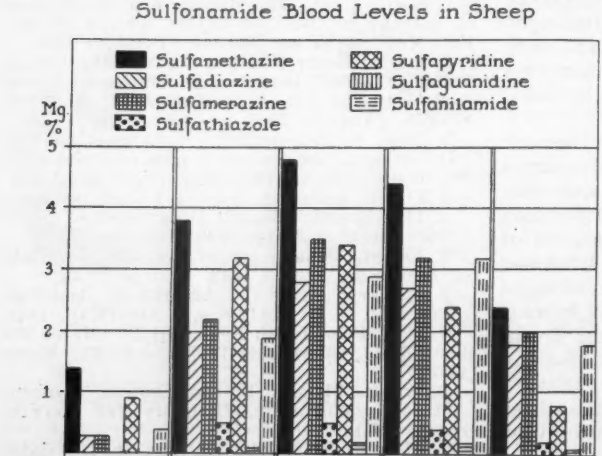
Figure 2 summarizes blood concentrations obtained by subcutaneous administration of sulfamethazine. An effective blood concentration was recorded at one hour which continued to rise to a peak at the eight-hour sampling, and, thereafter, gradually declined. On the second and third days, there was the characteristic rise following drug administration, to a high at about the fourth hour. Therapeutic levels were maintained throughout the test.

Average blood concentrations following oral administration are shown in Figure 3. Very little absorption was evident at one hour. This would indicate that, in the acutely ill animal, an immediate high level should be obtained by parenteral administration, and maintained by oral dosing. Blood concentrations continued to rise through the eight-hour sampling and, at 12 hours, the same level was recorded. In this instance, had determinations been made within this four-hour period, a different graphical picture might possibly have been presented. Maximum levels were not so high as those attained following subcutaneous injection, but were maintained at effective levels throughout the three days of the test. At the dosages used, there were no evidences of systemic toxicity.

As has been shown in the other experiments in this series with various species of animals, effective blood concentrations can be quickly attained and maintained by giving the drug daily.

*The authors are indebted to Mr. Harry Mundle and Mr. S. C. Griffith, of the Animal Industry Section, for aid in the conduct of the program, and to Mr. S. Senn, of the Analytical Section, Lederle Laboratories Division, American Cyanamid Company, for sulfonamide analyses.

Figure 1



In treating acute bacterial diseases in animals with sulfonamides, the achievement of the highest blood levels possible, short of producing toxic symptoms, should be the objective, since it is impossible to determine the degree of susceptibility of the host, or the activity of the sulfonamide against the pathogen in the field case. The value of the animal, the cost of labor, the veterinarian's time, and the money saved in a quick recovery justifies using optimum dosage. If treatment fails on optimum dosage, it would be presumed that the infectious agent is not sulfonamide-susceptible, and other treatment could be quickly instituted.

Figure 2

Sulfamethazine Blood Levels in Sheep

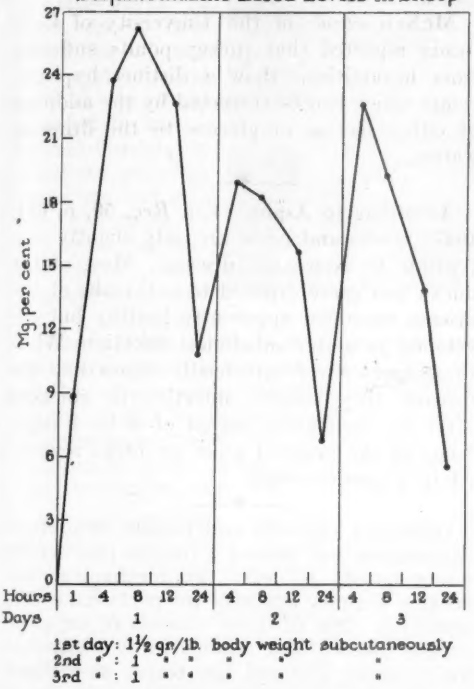
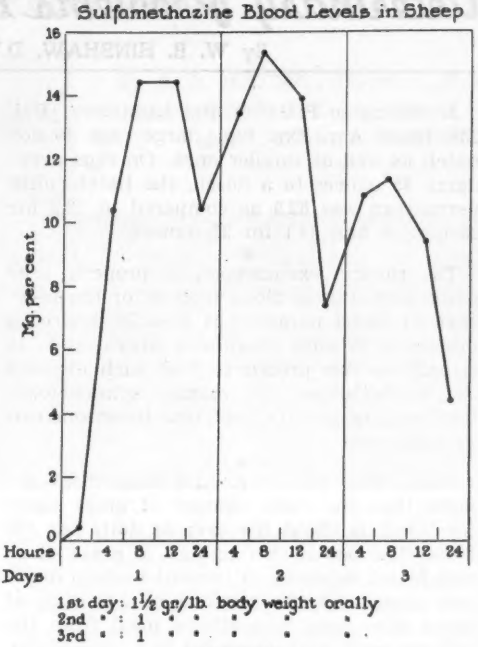


Figure 3

Sulfamethazine Blood Levels in Sheep



Summary

1. Sulfamethazine was given to normal sheep, both subcutaneously and orally, and blood concentrations were determined at regular intervals thereafter.

2. Both methods of administration resulted in the attainment of blood concentrations considered to be bacteriostatically effective.

3. On the basis of the results obtained, the dosage of one and one-half grains per pound of body weight on the first day, and one grain per pound on subsequent days, will maintain optimum blood concentrations.

4. No evidences of toxicity were noted.

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Veterinary Problems in Poultry Production

By W. R. HINSHAW, D.V.M., Ph.D., Davis, California

According to Petersen and Lampman (Bul. 269, Idaho Agr. Exp. Sta.) large eggs do not hatch as well as smaller ones. On eggs averaging 25 ounces to a dozen, the hatchability percentage was 82.9 as compared to 72.3 for 28 ounces and 34.1 for 32 ounces.

The routine examination of properly prepared and stained blood smears for the presence of blood parasites is a sadly neglected procedure in most diagnostic laboratories. It is only by this procedure that such diseases as leucocytozoan infections, spirochetosis, bird malaria and Hæmoproteus infections can be diagnosed.

Platt (Bul. 734, N. J. Agrl. Exp. Sta.) reports that the right amount of grass silage for layers is about five pounds daily per 100 hens. The use of this amount of grass silage was found sufficient to prevent embryo death loss caused by the removal of 5% each of dried skim milk and alfalfa meal from the breeder mash with grain fed as a supplement. Grass silage did not result in any greater efficiency of feed ultilization.

Many poultrymen are now raising chicks in battery brooders, in which the space per chick is much less than when brooded on the floor. The approximate space needed is given in the following table:

Age of Chick	*Space per Bird*
To 1 week of age	8 to 9 square inches
2 to 3 weeks of age	16 to 18 " "
4 to 6 " " "	22 to 25 " "
7 to 9 " " "	32 to 36 " "
10 to 11 " " "	44 to 50 " "
12 " " "	53 to 60 " "

Beaudette *et al.* (*Am. J. Vet. Res.* 9, p. 190. 1948) tested the viability of viruses after drying and storing for various periods. One strain of laryngotracheitis virus remained active for 3359 days, while a second was alive on the 927th day but not at 1052 days. Strains of fowl pox virus were viable from 1687 to 3598 days; pigeon pox virus from 2602 to 3605 days; canary pox virus from 1106 to 2571 days; and turkey pox virus to 1458 days. Chick bronchitis virus remained alive in the dried state from 232 to 3053 days but was not infective for more than 684 days. Two bronchitis-like strains retained their activity for 3021 and 3077 days.

The largest land vertebrate eye is that of the ostrich. It is 50mm (two inches) in diameter. *Wall,* The Vertebrate Eye.

McNeil *et al.* of the University of California reported that turkey poults suffering from hexamitiasis show a distinct hypoglycemia which can be corrected by the addition of either lactose or glucose to the drinking water.

According to Asplin (*Vet. Rec.* 59, p. 621, 1947) ducks and geese are only slightly susceptible to Newcastle disease. Most of the ducks and geese exposed to outbreaks of the disease remained apparently healthy but developed an active subclinical infection. When these species were artificially exposed to the disease, they became infective to chickens after an incubation period of 3 to 4 days. None of the infected geese or ducks remained in a carrier stage.

Debeaking chickens and turkeys to prevent cannibalism has become a routine practice on many farms. At least two mechanical debeakers are now available for performing this operation. One of these consists of an electrically heated and automatically controlled knife blade. The red hot blade, when used for severing a portion of the upper beak simultaneously sears the cut surface to prevent bleeding. The second type consists of an electrically heated rod which is used to burn off the beak to the desired length. Birds so debeaked, suffer no ill effects, eat normally, do not have cannibalistic habits.

Histomoniasis (enterohepatitis, blackhead) is primarily a turkey disease but it is a well known fact that young chickens may also succumb to it, although they are generally resistant. Beaudette and co-workers (N. J. Agr. Exp. Sta.) have reported that fowl pox vaccination of young chickens may be followed by an increased number of cases of histomaniasis in the vaccinated birds. This increase is presumably due to the increased susceptibility caused by the lowering of resistance by the fowl pox vaccine. Ruffed grouse, quail, guinea fowl, pheasants and peafowl have also been reported as susceptible to the disease.

Observations on Canine Encephalitis*

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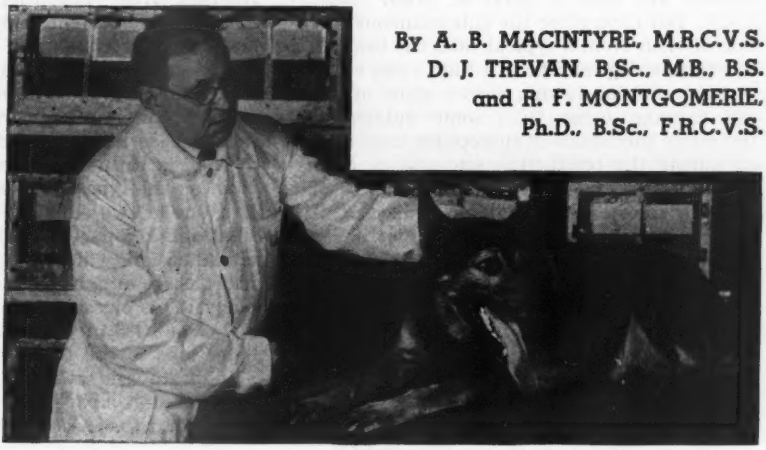


THE title of this paper was chosen to afford us the opportunity to describe our findings, in an incompleted piece of work, in a field which is of particular and topical interest to those engaged in small-animal practice. It is not our intention to review and discuss the work of the many authors who have probed this difficult subject — canine encephalitis. That might be regarded as an unnecessary occupation of the time at the disposal of this meeting. It seemed better that we should give an account of our curren views and the ground on which we base them, as a stimulus to others to describe their experience and air their views, to the benefit of us all.

Strictly speaking, the term encephalitis should be applied only to conditions in which there is an inflammatory change in the brain. However, it has acquired a clinical application far beyond that of the pathologist, so that today it is common to find veterinary practitioners describe as encephalitis any condition in which the symptoms suggest involvement of the brain. These symptoms vary widely; from a change in temperament to screaming fits, from a lack of muscular co-ordination to coma or convulsions.

Many cases showing these symptoms, particularly those of the less grave type, are not suffering from a true inflammation of the brain, and quite a number recover following simple treatment. We have seen dogs with such continuous convulsions that they could rarely stand, return to normal within a few days, following a change of diet to one containing an ample supply of meat. This may have been due to the removal of a toxic constituent in the original diet, possibly that associated with agenized flour as suggested by the observations of Sir Edward Mellanby. In other cases, toxemia arising during the course of bacterial infection has set up symptoms which have led to a diagnosis of encephalitis. In some of the carcasses sent to us by practitioners interested in obtaining material for our encephalitis investigation, the only lesion was a purulent pneumonia, yet the history was one of cerebral disturbance. Uremia following kidney damage due to leptospira infections or due to dehydration following a sustained febrile illness or continuous vomiting and diarrhea, is often associated with convulsions.

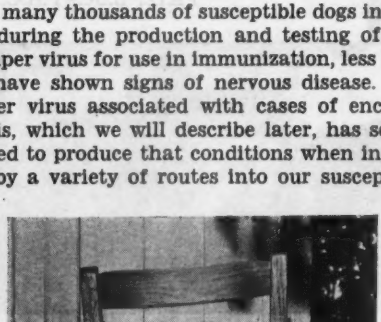
It is generally accepted that certain deficiencies are characterised by symptoms related to dysfunction of the central nervous system. Lack of aneurin (vitamin B_1) in the diet of the dog leads to loss of appetite, nervousness, convulsions and chorea; and in these cases the administration of large doses of the vitamin brings about dramatic recovery. Pantothenic acid is needed by the dog, and a deficiency quickly leads to gastritis, enteritis, convulsions and coma. On post-mortem examination the gastritis-enteritis is accompanied by intussusception. Several such cases have been among our series of clinically accepted encephalitis.

Frank cases of rickets in puppies not uncommonly show convulsions; and the convulsive states associated with helminthiasis in the young are another example of the type of condition which can be mistakenly diagnosed as encephalitis.

Many cases of so-called encephalitis are, however, associated with the invasion of the brain by an infectious agent. In some instances this agent is the true distemper virus of Carre, yet the strains of the virus isolated from these cases have had no real neurotropic properties. Injected by a variety of routes, in-

*Presented at the 66th Annual Congress of the National Veterinary Medical Association of Great Britain and Ireland September 8-15, 1948 and supplied through the courtesy of General Secretary F. Knight, Esq.

cluding the intra-cerebral, these strains have produced in susceptible dogs typical distemper, without any sign of nerve or brain involvement. Ten days after the subcutaneous injection of virus from a typical case, the brain of a susceptible dog may have a high virus content without the dog having shown signs of nerve cell damage, other than some dullness. Of the many thousands of susceptible dogs injected during the production and testing of distemper virus for use in immunization, less than 20 have shown signs of nervous disease. Another virus associated with cases of encephalitis, which we will describe later, has so far failed to produce that conditions when injected by a variety of routes into our susceptible



Frank cases of rickets in puppies not uncommonly show convulsions; a condition which mistakenly can be diagnosed as encephalitis.

dogs. But, encephalitis due to one or other of these infectious agents is a common occurrence in most small-animal practices and may, indeed, occur after the use of live virus in immunization. We are driven to the conclusion that, particularly in these days of difficulty in procuring proper food for dogs, impaired nutrition is an important factor in the causation of canine encephalitis. It may act either by preparing the way for the entry of virus which does not normally attack nervous tissue or by creating a state in which minimal damage shows to maximal extent. Some such hypothesis is necessary to explain the observations which we have made; for the only true neurotropic virus infecting the dog is, apparently, that of rabies.

We recognize that any of these factors may be responsible for the production of nervous disorder, clinically diagnosed as encephalitis, but that the cases associated with a virus infection are usually more severe and almost always more difficult to treat successfully. For a period of years we have been attempting to sort out these conditions by investigating their etiology and pathology. To this end we have received from practitioners much material mostly post mortem, but occasionally in the late ante-mortem stages. It was soon apparent that a classification could not be based solely on the history and symptoms supplied or observed. This is not surprising, since the signs in any case must depend largely on the part of the central nervous system involved, rather than on the type of lesion existing. Nevertheless, one or two clinical characteristics appear to attach to a particular group in our tentative classification, which is based on the histological picture and, in part, on evidence as to etiology. This classification is as follows:

Group I.—In which a filterable agent, infectious to the ferret, can be demonstrated in brain and other tissues, is divided into two sub-groups:—

Group Ia.—Associated with infection with the true distemper virus of Carre; the brain lesion is essentially that of destruction of nerve cells without inflammatory changes or demyelination.

Group Ib.—Associated with infection with a virus differing from that of distemper; the brain lesion is a demyelinating and inflammatory encephalitis. A remarkable hyperkeratosis of the foot pads is a feature so common in these cases that the condition has come to be known as "hard pad disease."

Group II.—A demyelinating, inflammatory encephalitis which is not infectious to the ferret, but which in one of several attempts was transmitted to a dog.

Group III.—An encephalitis, inflammatory but not demyelinating, which is apparently not infectious.

Group IV.—An encephalitis apparently caused by protozoal invasion of the brain; a toxoplasmosis, probably of rare occurrence.

Group V.—Miscellaneous conditions, the majority of nutritional or toxic origin.

We have every reason to believe that the conditions which we have placed in the first four groups are entities. We will describe their main features, particularly those of Group Ib (hard pad disease) since we consider it responsible for the epizootic which has caused so much concern during the past two or three years. We will later illustrate our findings by a series of lantern slides and we have a set of specimens available for inspection.

Group Ia.—This encephalitis may occur towards the end of the acute phase of typical distemper, generally following pneumonia, but is more common some weeks after apparent recovery. Its appearance while symptoms of distemper are still in evidence is almost confined to cases in young puppies, and the nerv-

ous symptoms are largely due to a secondary toxemia or septicemia. The rigors, stupor and coma often suggest encephalitis. In the dog recovered from the acute phase of distemper, the symptoms are of the choreic type, appearing first in the masseter and temporal muscles, and spreading to the limbs and body. Epileptiform convulsions, while they do occur, are not prominent in the early stages, and are seldom the only nervous symptom.

Post-mortem examination shows little that would suggest encephalitis. The brain may be congested; a few tiny hemorrhages and an excess of cerebrospinal fluid may be present. A leptomeningitis may be suspected, but more usually the brain is normal in appearance. Other organs are generally congested, the lungs showing collapse and pneumonia, the lymph glands enlargement and the bowel wall enteritis, but the whole picture may be complicated by the effects of secondary infections.

Histologically, the brain shows severe destruction of nerve cells, particularly in the cortex, and many small hemorrhages. Some gliosis may be present, but there are no other inflammatory changes. We have seen no inclusion bodies, and there is no demyelination. In the lungs there is a histiocytic interstitial pneumonia, in small patches, which nearly always becomes secondarily infected and infiltrated with polymorphs. The bronchial epithelium contains cytoplasmic inclusion bodies.

The injection of emulsions of brain and other tissue from cases of this sub-group has regularly produced typical distemper in the ferret. After an incubation period of nine to eleven days, at the most 15 days, dullness, watery ocular and nasal discharge, swelling of the eyelids and congestion of the muzzle appear. The discharges soon become purulent and vesicles form in the skin of the lips. The eyelids become glued together, the vesicles rupture and scabs form. Recovery is rare and death usually supervenes within three days of the appearance of symptoms. Nervous symptoms, other than a hyperesthesia, are rarely seen, probably because the duration of the disease in the ferret is so short. Laidlaw and Dunkin saw one or two cases in which nervous symptoms were prominent, and sections of the brain from these cases showed only death of nerve cells.

Prior to 1945 all our encephalitis cases from which a virus was demonstrated in this way had the histological picture described above.

The strains of virus from these cases produce typical distemper in the dog, without the appearance of nervous symptoms, and they are readily neutralized by distemper antiserum.

Group Ib.—Reports that distemper prophylactics had failed to protect and that immunized dogs became affected with so-called nervous distemper, first focused our atttention on this disease. Instances in which repeated doses of serum had failed to protect in-contacts, and the use of as much as 400cc of serum at the very outset of illness had afforded no benefit, were brought to our notice. Yet the serum was known to be of high antiviral content when tested against Carre virus. The case history of many of these dogs was not typical of distemper, and ferrets inoculated with tissue emulsions from dogs that had died of this disease were unaffected after the normal 15 days' observation. It had always been our practice to test the immunity of ferrets surviving following an injection for diagnostic purposes by injecting stock distemper virus 15 to 17 days after the original injection. Although most of these ferrets developed distemper in the standard period of eight days after the challenge dose, some were ill with a distemper-like disease within four or five days. Such illness could only be related to the original injection, and when the period of observation was extended to one month, it was seen that in some cases a disease appeared in the ferrets long after the 15-day interval. We then realized that some of the former tests for virus must have been mistakenly accepted as negative.

In the autumn of 1946 Dr. Margret Scheitlin of Zurich visited our laboratories, and during our discussion of canine encephalitis, described a hardening of the foot pads which she had seen in Switzerland. Where this remarable lesion was observed she could predict with fair certainity that nervous symptoms would develop within a few days. We were soon able to confirm this observation in our cases, and practitioners to whom we mentioned this curious circumstance have found and presented us with many examples of it. The condition which we classify as Group Ib has this symptom as its most outstanding and characteristic feature, and has come to be known as "hard pad disease."

This disease affects dogs of all ages. We have seen it in puppies that sickened at six days of age, and have recently had a case in a nine-year-old dog.

When catarrh is present, the discharge is thin and watery and rarely of the copious purulent type so common in distemper. Many acute cases show little or no nasal discharge, but in those of some standing a rather scanty secretion crusts at the nostrils.

A moderate tonsillitis with enlargement of the cervical glands and some swelling of the other lymph glands is a regular feature.

Usually there is fever, irregular and intermittent; sometimes the temperature is as high as 106.5°F. in the early stage. Yet, in some

cases a sub-normal temperature persists through the illness. The febrile reaction is a contrast to the diphasic fever so characteristic of distemper.

Severe diarrhea is common. In fact, violent diarrhea and, in greyhounds, dysentery are almost constant symptoms.

Cases often show fast, shallow breathing suggestive of pneumonia, but no signs of consolidation can be detected on clinical examination. Indeed, post-mortem examination of these cases reveals no more than a few small patches of interstitial pneumonia, seldom extensive or secondarily infected, although pulmonary edema and congestion are common. There is evidence of acute degeneration of the heart muscle fibres, but this is hardly sufficient to account for the pulmonary symptoms on a basis of heart failure, and it may be that the edema of the lungs is neurogenic in origin.

The outstanding and relatively constant feature of this disease is the remarkable hardening of the foot pads. We believe that it occurs to some degree in every case but varies from a hyperkeratosis only recognizable histologically to very marked thickening and hardening which results in distinct tapping as the dog walks on a firm surface. Grossly thickened pads may have a keratin layer a quarter of an inch thick. Others remain thin, but have the hardness of metal, and occasionally a "corn" is present in them. The pads are seldom painful but some feel hot. The hardening becomes so marked that when pressed from the side they are unyielding, in contrast to the rubbery nature of the normal pad. This feature appears within one week of the onset of illness, the pads at first showing little more than slight swelling, and some disappearance of the papillae, which gives a smooth glistening appearance. The rate of development varies, but generally by the end of a further week the pads have the characteristic appearance. In some cases which have been affected for several weeks, a similar hyperkeratosis of the nose has been seen.

In the fulminating type, fits are often the first symptom observed, and after a succession of severe convulsions the dog may be dead within one week. In the majority of cases the symptoms of encephalitis appear at the same time as, or within a few days of, the hardening of the pads. Occasional convulsions with loss of consciousness, lasting only a few minutes, soon become more frequent and more lasting until the animal becomes comatose and dies. Screaming fits, blindness and paraplegia are less common; chorea, is seen chiefly in the more chronic cases.

Cases have been reported in which the hardened pads desquamated, but in about 90% of dogs affected, encephalitis leading to death (or euthanasia) has followed within two weeks of the appearance of the pad condition.

The post-mortem picture is somewhat variable depending on the severity of the disease. In some, little is found beyond the changes in the foot pads, an enlargement of the lymphatic glands and some congestion of the lungs. In many, a notable feature is congestion, hemorrhage and edema of the lungs, with small scattered patches of grey consolidation, usually sub-pleural, and not extending more than a few millimetres into the lung substance. These patches are more easily felt than seen. Excess of clear pleural fluid, excess of pericardial fluid and sub-epicardial hemorrhages are common. Gastritis is usually marked, and sub-peritoneal hemorrhages occur along the lesser curvature of the stomach. Severe enterit throughout the duodenum, and elsewhere patchy, is usual, and the contents of the bowel are commonly blood stained. The spleen is markedly congested, the liver similarly affected, and the gall bladder engorged. A hemorrhagic cystitis is common. The inflammatory condition of the brain is not evident to the naked eye, apart from the appearance of meningeal congestion.

Histological examination, besides confirming these post-mortem findings, shows that the brain lesion is essentially a demyelinating encephalitis occurring in small scattered focal areas, typically in the cerebellar peduncles and folia; often, when elsewhere, sub-meningeal or sub-ependymal. There is glial proliferation, swelling and proliferation of the vascular endothelium sometimes with histiocytic "cuffing" of vessels. Intranuclear inclusion bodies, weakly acidophil, occur in glia cells, histiocytes, ependyma cells and occasionally in meningeal endothelial cells. They do not appear in vascular endothelium as described by Green for fox encephalitis. Between the nuclei, among the glial network, can sometimes be seen structures like inclusion bodies which are presumably in the unstained cytoplasm of glia cells. There are also curious masses of finely vacuolated "colloid" material containing no nuclear structures but surrounded by glia-like nuclei often containing inclusions. Despite prolonged search we have never seen inclusions in nerve cells.

Lung tissue shows a picture somewhat similar to that seen in true distemper. There is a histiocytic interstitial-cum-alveolar pneumonia often in tiny patches with cytoplasmic acidophil inclusion bodies in alveolar and bronchial epithelial cells. Extensive polymorph infiltration and purulent resolution are much less common than in distemper. There is severe congestion, hemorrhage and edema.

The pads show great thickening of the horny layer and proliferation, distortion and premature keratinization of the prickle cells, so that deep into the horny layer are often found pyknotic nuclei and nuclear fragments from cells which have keratinised before the normal loss of their nuclei.

The injection into the ferret of an emulsion of foot pad, of brain, of lung or of spleen tissue from these cases sets up a disease which bears some resemblance to distemper in this species. The incubation period is only occasionally less than 17 days and may be as long as 32 days,

When a neurotropic virus attacks the central nervous system paralysis ensues. Clinically, it does not differ from paralysis due to other causes.

the average for a large number of observations being 23 days. In investigating cases of this group, it has been our practice to inoculate into two ferrets each of the tissue emulsions just mentioned. The variability of the incubation period has been noticeable. One ferret of the pair may show symptoms as early as the 10th day; its companion not until the 28th. Those on pad emulsion may have an incubation period of 20 days, while those infected with brain emulsion show no symptoms until the 30th day. This rather suggests that the ferret is an unnatural host, and that the virus finds some difficulty in establishing itself. Ferrets injected with tissue emulsion from puppies which sickened when six days of age and died at 10 days, showed no symptoms until after the 20th day. The nasal discharge in infected ferrets is slight and watery, and conjunctivitis is not often purulent and rarely glues the eyelids together as in distemper. Vesicles are often absent and the muzzle is invariably moist. Although the ferret is obviously infected, the symptoms develop slowly and the disease is not violent; death may not occur until the 10th day of illness. In contrast to ferret infection with Carre virus, recovery is not uncommon. Concurrently with the appearance of other symptoms most ferrets develop hard pads, no matter what tissue emulsion has been injected. Despite the longer course of the disease definite nervous symptoms have not been seen in ferrets and there has been no histological evidence of inflammation of the brain.

We have earlier noted that the injection of Carre virus, no matter the route selected, produced distemper with all its classical symptoms but rarely, or never, evidence of nerve involvement. In contrast, the injection of the virus of hard pad disease into our experimental dogs produced only a febrile reaction, usually intermittent and lasting 10 to 14 days. Invariably these dogs return to normal without exhibiting any other symptoms. Recovery after the injection of either of these viruses left the animal immune to the homologous virus. Dogs which had been proved immune to "hard pad" virus showed the typical diphasic temperature reaction when injected with Carre virus and, conversely, distemper immune dogs often reacted to the injection of hard pad virus. It was noticed, however, that the reaction to hard pad virus was generally less severe in these cases. The injection of large doses of distemper antiserum from several batches, some prepared as long ago as 1937, failed to prevent infection with hard pad virus, and this virus has not been neutralised *in vitro* by high quality distemper serum. A proportion of dogs of unknown history, proved immune to distemper, have failed to react to the injection of hard pad virus. This may well have been due to their having an acquired immunity to the virus, and it suggests that non-clinical disease is not uncommon. We believe the serum protection tests and serum neutralization tests give a more certain differentiation than immunity tests in dogs. We do not regard the two viruses as being entirely unrelated but the differences we have noted from both the immunological and clinical aspects seem quite sufficient for their acceptance as entities.

Our failure to reproduce clinical hard pad disease has led us to conclude that factors in addition to the virus infection are responsible for its occurrence in the field. Among other things, our attention was attracted to the frequency with which cases went on to show the full clinical condition following treatment with sulphonamides in the early phase of the disease. We have therefore observed the effect of dosage with these drugs in dogs injected with the virus. Groups of four dogs were injected with virus. One dog in each group was left as a control, the other three being given full oral doses of a sulphonamide for the first eight days after infection. A control group of

dogs were given drug alone without virus. In the case of two of the drugs used, five of the six dogs had fits from about the 11th day onwards; that is after the drug had been discontinued. There was histological evidence of a demyelinating encephalitis in one case and of hyperkeratosis of the pads in three. None of the dogs on virus alone or on drugs alone showed any nervous symptoms. This observation tends to confirm the suspicion which arose in field work that the administration of sulphonamide drugs is one of the factors leading to full development of the disease.

Group II.—This disseminated demyelinating encephalitis has a histology somewhat similar to that of Group Ib but is chiefly distinguished by the failure to infect ferrets with Seitz filtrates of tissue emulsions.

Clinically the disease is insidious in onset and slow to progress. Dogs of all ages have been found affected. Signs of generalized infection are slight or absent; there may be a mild catarrhal conjunctivitis and a dry cough with slight enlargement of lymph glands. In many cases these signs have cleared up before the appearance of nervous symptoms, and most cases have presented as a purely nervous disease. The dogs have convulsions. They may show paralysis, chorea or ataxia. A feature which we have come to regard as characteristic is a tendency to walk in circles to one side or the other, bumping into objects but continuing the same circling movement when the obstruc- is removed. General body condition is fairly well maintained, the animal usually dying in coma. At post-mortem examination, the brain appears normal but may be somewhat congested. The lungs are often normal but where the terminal coma has been protracted there may be a severe pulmonary congestion and edema. There is no pneumonia, and there are no constant changes to be seen in other organs. Histological examination of the brain shows a demyelinating encephalitis; there are small foci of demyelination, gliosis, histiocytic cuffing of blood-vessels, and thickening of vessel walls. There are intranuclear inclusion bodies in glia cells near the cuffed vessels; but there is hardly any damage to nerve cells, and we have not seen ependymal inclusion bodies. The lung may show congestion and edema, or it may appear normal; there is no pneumonia, nor are there inclusion bodies in bronchial epithelium. There are no significant changes in other organs, and the pads are normal. Ferrets injected with Seitz-filtered material from these cases remain normal. Attempts have been made to reproduce the disease in dogs in this way. Of several dogs injected intracerebrally, one developed circle walking, rigidity, difficulty in accommodation and convulsions, without loss of consciousness. Histological examination of this case showed a typical Group II encephalitis; the pads were normal.

It therefore seems that there is a demyelinating encephalitis of dogs other than hard pad disease.

Group III.—This condition was fairly common 10 or 15 years ago, but at present it appears to be relatively rare. Most of our cases have been in older dogs. The history is of the insidious onset of a purely nervous condition; there are no signs of respiratory disease or of generalized infection. The dog becomes dull or shows other changes in temperament; it wanders about aimlessly and has repeated fits. There is usually no evidence of permanent damage to nervous functions such as would be shown by paralysis, ataxia or sensory loss. The general condition remains good, and the dog may live for a long time. In some suspected cases, the fits have stopped and the dog has apparently recovered. In those cases that come to post-mortem examination there are no typical naked-eye abnormalities. Sections of the brain, however, show the most noticeable feature to be a cuffing of the blood vessels with small cells, mostly lymphocytes, lying in the perivascular space. There is also thickening of the vessel wall, and there are no inclusions, nor is there any demyelination, although where a vessel in white matter is heavily cuffed, an appearance of demyelination may be produced, as the fibres are pushed aside by the large cuff. There appears to be no damage to nerve cells. We have seen no significant change in the other organs. Ferrets injected with Seitz- filtered material have remained normal, and the few attempts that we have made to transmit the disease to dogs have failed.

Group IV.—We have reserved this group for cases of protozoal infection of the brain which are known to occur in other countries, although we have only one definite case in our series. It was a case of toxoplasmosis and probably the first reference to the condition in the dog in this country.

This particular dog from a country district was reported to have been vaguely off color and running a high temperature for two weeks before fits and temperamental changes appeared. It was destroyed and sections of its brain and other organs were submitted to us. The brain showed a large area of necrosis in the medulla; the area was sparsely infiltrated with glia and plasma cells. Many toxoplasma were present, singly and in clusters or "pseudocysts."' The blood vessels in the area were cuffed with plasma cells. The lungs showed an alveolar pnuemonia but no parasites could be seen in the sections.

Previous to this we had a case, a dog which showed nervous symptoms, in which the histological findings in the brain were indefinite but the heart muscle showed a destructive inflammatory lesion associated with protozoa resembling toxoplasma in clusters within the heart muscle fibres.

Group V.—For the present, we have left collected together those conditions with which we have very little experience, or which appear to be associated with nutritional deficiency, intoxication or helminth infestation. Histologically they do not fit into any of the above groups.

Treatment

Some might regard this contribution as incomplete, if we did not say a word about the treatment of these conditions.

Since we have been unable regularly to reproduce the various types of disease which we have described, we have had no opportunity to study methods of treatment in controlled conditions. We have, however, collected much information from practitioners who have adopted procedures which we have suggested.

Where damage to the nervous system has been severe and complete, functional recovery never occurs, so that the dog is left with a residual symptom of the disease, such as altered mentality, defective vision, deafness or muscular incompetence, etc. Specific antisera have been used in the Group I conditions. Distemper antiserum has little therapeutic value in cases of distemper already showing nervous symptoms. Its value as a prophylactic is undoubtedly high. We have prepared experimental batches of serum by hyperimmunising dogs with the virus of hard pad disease. Used therapeutically, this serum has given some encouraging results; but only where it has been used in the early phases and repeated about every five days, for a period of four to five weeks. In some cases its intrathecal injection in 10cc amounts into dogs already showing nervous symptoms has been followed by definite improvement in the clinical condition. Animals in contact with this disease appear to have been protected by the injection of serum. As yet, we have been unable to produce the serum in quantities large enough for general issue. However, one cannot rely on specific treatment with confidence. The measures adopted should, then, be those directed towards assisting the natural recuperative processes. This is specially the case in hard pad disease in which almost all the organs become involved.

In all encephalitis-like cases early consideration should be given to diet. It must be adequate as to protein, vitamin and mineral content. The feeding of flesh should be supplemented by access to offal, yeast or other vitamin rich foods. Flour, in any shape or form should be avoided, as very little of the bread, brown or white, available in Britain to-day, is unagenized. Crude cane sugar molasses has been found of value, probably because of its content of the vitamin pyridoxine, a deficiency of which may lead to convulsions and chorea in addition to pnuemonia. Molasses feeding may, however, aggravate an existing diarrhea. Aneurin (thiamine) in very large doses has been used with variable effect. Certain Dutch investigators have advised the use of strong liver extract, injected intramuscularly in 2cc doses on two successive days. Although this line of treatment appears to have little effect in many cases, it has been used with apparent success in some cases of chorea.

In most cases, particularly those of Group I, dehydration is marked, especially when diarrhea is prominent, and the subcutaneous or intravenous injection of glucose saline is essential. In these cases the adminstration of vitamin B by injection is of value because the alteration of the intestinal flora prevents synthesis of this vitamin and there is defective absorption.

We have referred earlier to the grounds on which we believe sulphonamides are contra-indicated, particularly in cases of Group Ib. Where there is fever and some tonsillitis, the use of penicillin is preferable.

The pulmonary edema in cases of Group Ib is of special concern. Professor Cameron has recently observed that acute edema of the lungs can be produced in rabbits, by injection of fibrin solution into the cisterna magna, and that this edema can be prevented by section of the vagi or by the injection of atropine. It is possible that the edema of the lungs seen in these dog cases is neurogenic, so that treatment with atropine would be appropriate. We have, as yet, had little opportunity to apply this suggestion.

With a view to encouraging the full intake of food and water the use of hypnotics is contra-indicated. Although they may be demanded to control screaming fits, it is advisable to try the effect of less powerful remedies such as aspirin to allay pain.

Treatment of these conditions is so difficult, that we emphasize rather the need for finding and appying adequate prophylaxis.

"DOGWOOD"

This building was erected in 1929. Much landscaping has been done since the photograph was taken, 16 years ago. It stands on a three-acre plot, four miles from Charlotte, N. C., fronting on a 44-foot, 4-lane U. S. highway. Electric current is supplied by a utilities company and water is from a deep well on the premises, equipped with an automatic electric pump.

Dr. H. Calvin Rea, the proprietor of Dogwood, was one of the first to construct an animal hospital outside city limits. He acquired the plot in January, 1926, and immediately constructed 80 outdoor kennel runways having natural drainage, shade and sunshine. Then he applied to several loan agencies for funds to construct a modern hospital. "Build a dog hospital, and in the country!" Without exception and not always diplomatically they advised him to consult a psychiatrist. Therefore he was forced to build a low-priced, frame office and hospital. The venture was successful from the start and three years later the building shown in the illustration was erected. The frame building has since been used as a residence for one of the attendants. In addition to the hospital facilities, the lot supplies an ample quantity of garden produce, poultry, eggs and pork for the hospital personnel.

Doctor Rea says: "The same buildings, on a lot one-fourth the size, in the city of Charlotte would have cost twice as much. Advantages of a country over a city location outweigh the disadvantages by overwhelming odds."

Store Building Converted to Veterinary Hospital*

By W. M. Thies
Hillsboro, Kans.

Restrictions on building material have been such for the past three years that constructing a building for a small animal hospital has been out of the question. Hence I purchased a building on Main street. I believe that in a small town in this section it is best to locate a veterinary hospital in the business district. One gets considerable small office trade in such a location from persons who would not bother to drive a few blocks to get their supplies. In this community, a new and growing dairy section, which has had no veterinary service heretofore, the farmers have the habit of going to the drug stores for medicines for their animals. Now that I am located as convenient to the trade center as the drug stores, this trade is coming to me in increasing amounts. It includes such preparations as disinfectants and dips, udder ointment, insecticides, wound applications, calf scour medicine, poultry tablets, etc. It isn't a matter of swivel chair diagnosis. These are preparations that the farmers are going to use themselves, wherever they get them.

I remodeled the interior of my building completely and also put in a new front. It has a frontage of 25 feet on the street and extends back 120 feet. It was not the shape I should have built, of course, but was about all I could get.

The front 60 feet was equipped for an office waiting room and small animal hospital. The rear 60 feet is divided into two rooms. In one there are three box stalls, four stanchions and a "squeeze." The other room has two large doors through which farmers can drive a truck or a pickup from the alley right into the building to unload their animals. Behind the building there is a small holding corral equipped with a loading chute.

The front half of the building contains a waiting room in which are show cases for dispensing and a private office which opens directly into the laboratory and the examination room. Adjoining the examination room is the drug room and directly across the hall is the surgery with the general ward to the rear. The large basement has ample space for an isolation ward, storage space and heating plant.

This layout is not what I should like to have or hope to have sometime, but, under the circumstances, it is working out satisfactorily. It is a whole lot better than "practicing out of one's vest pocket." I believe the central location is the right one for a small village.

*This article and the one by Doctor Erikson, which follows are reprinted from the January 1946 issue of *Veterinary Medicine* in response to a large number of requests.

A Small Hospital in a Small Town Pays

By A. E. ERICKSON
Charlotte, Michigan

The Erickson Veterinary Hospital is located in the City of Charlotte, Michigan, a town of 5500 population in a predominantly rural section. Our practice is a general practice; probably 65 or 75% of our work being with farm livestock in the surrounding farming country.

We are just inside the city limits, about a mile and a half from the business section of town, on a state and federal highway which carries a great amount of traffic constantly. This highway location we feel is quite important. We were located downtown for 18 years and were told when moving was being considered that our patrons would not come out to our present location, but that did not prove to be true.

I have been interested in veterinary housing ever since I was in school, near 30 years ago, and long ago came to the conclusion that the average veterinarian is very poorly housed, and usually is a terrible housekeeper.

Mrs. Erickson and I have visited many places in Michigan and surrounding states, where a veterinary practice is conducted. It goes without saying that they are nearly all disappointing; they are poorly located, the buildings are not attractive; their housekeeping is usually very bad, and a large percentage of them, are a smelly mess.

There is no good reason why a veterinarian, should surround himself with such housing.

Of course some of this poor housing is from economic necessity, especially with some of the younger men who lack the required funds for better buildings and equipment. On the other hand, there are veterinarians who have reached a point, as far as finances are concerned, where it is possible for them to better themselves in this matter, but who still continue to do business from surroundings that are not a credit to a profession of any kind.

If through some construction magic or genius, veterinarians would become conscious of the fact that there is a definite need for housing themselves better, and keeping their houses better, it would enhance the standing of the veterinary profession as a whole, within a very short time.

This is one of the very few animal hospitals in Michigan built for that specific purpose.

Every thought in the selection of the location, the design and arrangement of the building, had the object in view of making it a satisfactory place from which to carry on the general practice of veterinary medicine.

I feel that these buildings for the practice of veterinary medicine should be located somewhat away from other buildings; they should be conspicuous and attractive in appearance, surrounded by spacious, well-kept lawns, and far enough from the highway to give easy visibility from the highway of the whole plant. Lawns, if well kept, add much to the attractiveness of a building.

Our building is constructed of cinder blocks, painted white, with plain blue awnings, red brick window sills, with a wide circular drive

in from the highway, which is easy of ingress and egress. The driveway is long enough and wide enough so many cars can park at the same time, without interference.

The building is 32 feet wide, and 52 feet long, with an L which serves as a garage, or box stall, 14 by 21 feet.

The entrance vestibulte leads into a waiting room which is large enough to accommodate several people comfortably. It is furnished with chrome and leather, modernistic furniture.

At the right of the waiting room as one enters the building, is an office 10 by 11 feet, the connecting door being in two parts, the lower part having a 12-inch shelf at the top for use as a writing surface, etc.

From the waiting room, opposite the entrance door, a hallway six feet wide extends through the center of the building from front

to back, which we think is very important, in giving the appearance of spaciousness. Narrow hallways and narrow doors are definitely out, where good appearance is a desideratum.

On the right of this hallway, immediately back of the office, is an examination room, which may be entered from the hallway, from the office, or from the outside. We consider this outside entrance to this room of great convenience, as in bringing patients in to the hospital, they can be brought directly into this room without disturbing those who may be in the waiting room or other parts of the hospital.

Immediately back of this examination room on the same side of the hallway is a small room used for a museum, containing a collection of 150 photographs of diseased animals, taken in this practice and about 100 pathological or teratological specimens, all also collected in this practice.

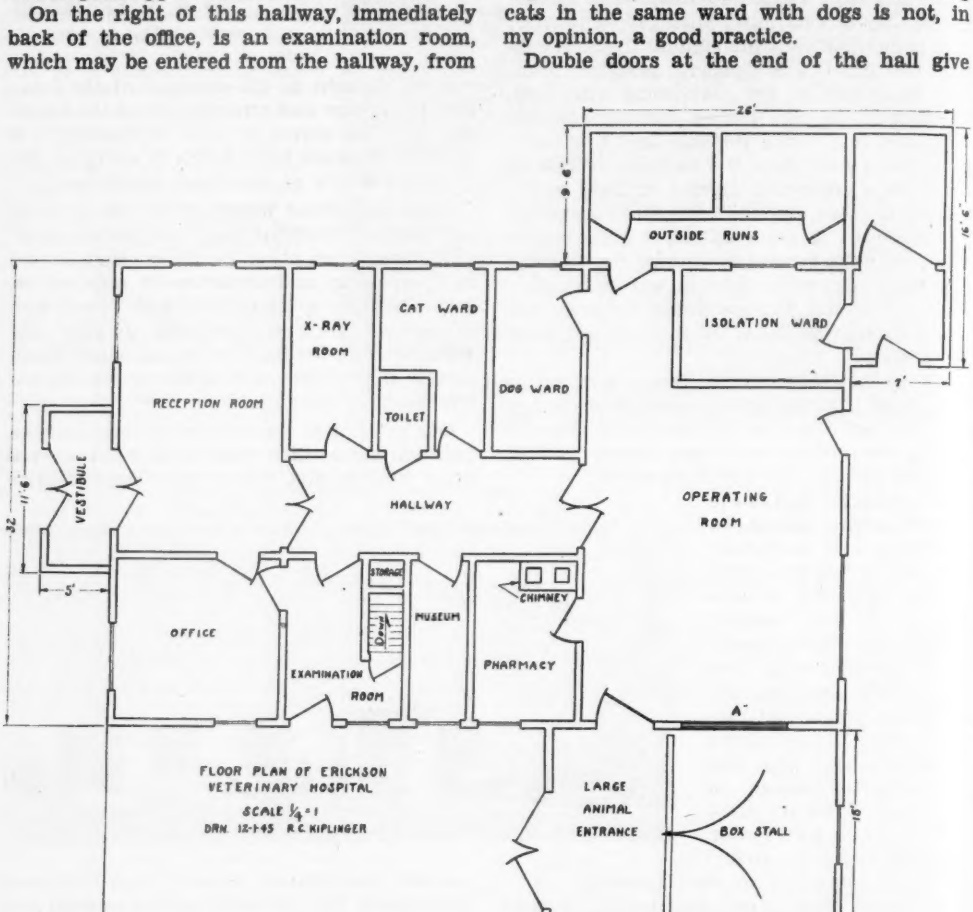
On the left of this hallway, just back of the waiting room and across from the examination room, is an X-ray and fluoroscopic room.

The next room back is a toilet room, and back of that the cat ward, which contains cages accommodating five animals. Placing cats in the same ward with dogs is not, in my opinion, a good practice.

Double doors at the end of the hall give entrance to a large room which contains operating tables, both equine and canine, instrument stands, and the necessary equipment for general veterinary surgery.

Off from this large room we have a small drug room, where we can sterilize instruments and dressings, prepare feed, make urine analyses, blood tests, etc.

From this large room there is also an entrance to the dog ward, which is so located that the dogs can be let out, conveniently, into an outside run with the least amount of handling. It might also be mentioned, in connection with these runs, that they are surrounded by a concrete wall four feet high.



with wire fencing above. We feel that this wall is especially important, because dogs, particularly strays, cannot contact through the runway fence as would be possible without the wall.

In the corner of the building, taken out of this large work room referred to, but unconnected with it, is an isolation ward, which has no entrance from inside the building.

We much prefer not to hospitalize animals with communicable diseases, but feel that it is necessary to have some isolated place to put an animal when emergency arises or for any reason it seems desirable to hospitalize such patients.

The part of the building which serves as a garage, also serves as an entrance to this large work room, and as a box stall for large animals.

There are two large wood gates, or doors which reach only part way to the ceiling, which divide this garage room into two separate spaces, so the front portion may be used for an entrance to the operating room, and the back part as a box stall. When these gates, or doors, are swung back against the wall, entire room may be used to house a truck, car or trailer if desired.

There is a small basement under the building, 14 by 32 feet, with windows at each end. This basement contains the heating plant, fuel storage, screen and storm door storage, shower bath, and dog bath.

All inside walls are plastered, smooth, and painted a dull ivory—no sheen at all.

All woodwork is walnut finish, also dull, with no sheen. The doors are birch with natural grain finish. All are wide, at least 36 inches, perfectly flat, no panels. The door casings are narrow, about one and one-half inches wide. We think that, in appearance, this inside finish is very attractive.

The floors, back to the operating room, are double wood, with moisture-proofing material between, and inlaid linoleum covering. They are kept as clean as possible and waxed at regular intervals. The floors, in the remainder of the building, are of concrete, smooth and painted.

The heating plant is a hot water system, stoker fed. Sixteen radiators of ample capacity insure easy heating of every part of the building, including the garage or box stall.

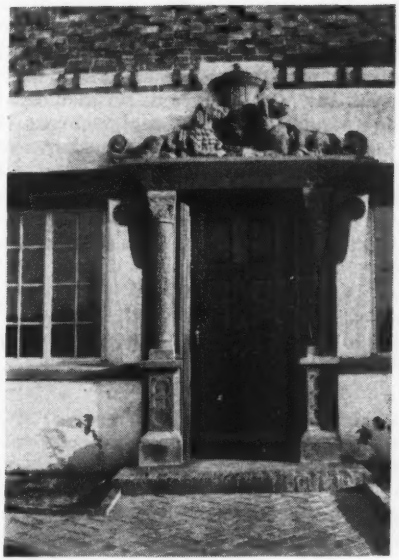
In the wall dividing the box stall from the operating room there are two horizontal doors, hinged at the bottom. One opens toward the operating room, and contacts the back edge of the operating table, and the door on the opposite side of the wall opens toward the box stall, and when lowered its edge rests on the bedding in the stall, the whole providing a slide, and opening through the wall through which a horse or other large animal can be moved from the operating table onto the bedding while still anesthetized.

The chimney is large, with a double flue, one side for the heating plant, and the other for ventilation, which is accomplished by registers and ducts from the dog and cat wards, the drug room, and other places where odors are likely to be prevalent.

The building is connected to the city water mains and with natural gas and electricity.

In addition to the toilet room, we have five other lavatories and outlets in various rooms for hot and hold waer.

This is a small hospital in a small town in a section well supplied with veterinarians. Within a 25-mile radius there are many practitioners, including a considerable number in the capital city and in Battle Creek. The Michigan State College clinic is less than an hour distant by truck, yet the practice that comes to us keeps four people quite busy—Mrs. Erickson, Mrs. Little, Dr. Paul T. Miller (MSC '44), and myself GR RAP '18). We find very little time to sit around, if we take care of the work that is always waiting to be done.



This attractive entrance, designed by Doctor Schreck several years ago for one of his hospitals, intangibly influences the public's opinion of how the veterinarian evaluates his institution. It also helps a large share of the public to fix the identity of the doorway in mind—to remember the place. A doorway such as this is as appropriate as the pharmacists mortar and pestle or the minaret on a Turkish mosque. It constitutes a sort of veterinary trademark

Furunculosis in Fish; Its Diagnosis and Treatment

By JAMES S. GUTSELL* and S. F. SNIESZKO*
Kearneysville, West Virginia

Occurrence

THIS disease, which receives its name from boil-like abscesses, frequently, but by no means always, present in the diseased fish, is very destructive of salmonoid fishes, especially salmon and trout. It was first described in Germany (Emmerich and Weibel, 1894) where it did much damage, first in hatcheries, later in trout streams, whence it spread over most of Europe. In 1911 there was a severe outbreak among the salmon of four rivers of southwest England and by 1926 it had spread to Scotland and done great damage. The spread of the disease and its destruction of trout and salmon led to the appointment by the British Government of a Furunculosis Committee, which made a notable study of the disease (Mackie *et al.* 1930, 1933, 1935).

Apparently the first record of furunculosis in America was in 1902, in Michigan. Marsh (1902, 1903), not being familiar with the European work, described the causative organism as "*Bacterium truttae*, new species." A quarter of a century later, Belding (1927) wrote of its "recent rapid increase" among the hatcheries of New England and the Middle Atlantic States. This increase seems to have followed the change from the practice of stocking streams with fry or small fingerlings to that of raising trout to a large fingerling size before planting. Of late years, furunculosis has spread to such an extent that comparatively few trout hatcheries have remained free from it. The financial loss has been very great.

In this country relatively little has been written of furunculosis outbreaks in streams and lakes. However this disease is known to have been very destructive in heavily stocked private and club waters, and it is probable that there are not many heavily stocked trout streams in which infected fish have not been placed.

Susceptible Species

Although there is great difference in susceptibility, apparently no salmonoid species is wholly immune.

The Atlantic salmon (*Salmo salar*) and its fresh-water subspecies, the so-called landlocked salmon (*Salmo salar sebago*) are very susceptible to infection and loss, but these fish are found in very few hatcheries.

The speckled trout or Eastern brook trout (*Salvelinus fontinalis*) is readily infected and suffers tremendous losses.

The brown trout (*Salmo trutta* or *Salmo fario*), introduced from Europe and popular in many parts of the country, is susceptible to a marked degree.

Two Western trout, the cut-throat (*Salmo clarkii*) and the Dolly Varden (*Salvelinus malma*), and Pacific salmon of the genus Onchorynchus are known to be susceptible.

The rainbow trout (*Salmo gairdneri*), a species native to the West Coast region (Pacific drainage) but widely grown throughout the Middle West and East (and abroad), is one of the least susceptible species. Even this species, however, suffers occasional heavy losses from furunculosis and often acts as a carrier.

Non-salmonoid fishes, such as minnows, if crowded and exposed to infection, sometimes contract this disease and die of it.

All this should be taken into account when the possibility of furunculosis is considered.

Conditions Favoring the Development and Spread of Furunculosis

Water temperature and the concentration of fish are most important for the development and spread of furunculosis.

In British experiments (Mackie *et al.* 1935), with a concentration of one fish per 40 cubic feet of water, an epizootic failed to develop; with one fish per 10-20 cubic feet, there was a pronounced spread of the disease; and with one fish per 6.5 cubic feet of water, there was a definite epizootic with very rapid spread. These figures are not quoted as standards, but as illustrating the ill effect of crowding and the advantage of plenty of space. Doubtless the rate of water flow and the size and behavior of the fish (especially their tendency to congregate or disperse) markedly affect the results.

Water temperatures of 15 to 18°C. (59 to 64.4°F.) were found most favorable for the activity and spread of the disease; whereas, temperatures of 5°C. (41°F.) and 21°C. (69.8°F.) proved relatively inhibitory (Mackie *et al.* 1935).

There is some indication that a sudden increase in water temperature has a greater effect on the incidence of infection and on mortality than a slow rise of the same amplitude.

Characteristics of the Disease

Furunculosis is an epizootic disease due to a general infection by a specific bacterium, *Bacterium salmonicida*, Lehmann and Neumann. This bacterium is carried by the blood to all parts of the body but tends to collect

*U. S. Fish and Wildlife Service.

in the liver, spleen and kidney. It destroys tissue by its histolytic action either in surface ulcers or internal abscesses. The latter action may bring death very quickly, with much evident agony.

Diagnosis cannot be definite without bacteriological, or serological, examination; but there are several indicative symptoms. These include: the typical boil-like open abscesses; other ulcers of a characteristic appearance, occurring most frequently at or near the base of the dorsal fin; red patches about the head; bloody areas in the muscle and visible through the skin, at least with fingerlings; fins which are bloody, especially near the base, and often ragged; a diffuse light pink coloration, sometimes over most of the fish, due to subcutaneous (petechial) hemorrhages; enteritis, especially in the hind-gut; and the breakdown of tissue, especially of kidney and spleen, into semi-fluid masses. In dying fish the blood may be brown, instead of red. Trout frequently dart about, especially at the surface, shortly before they die.

Diagnosis

As previously noted, the organism which causes furunculosis is *Bacterium salmonicida*. Unless this organism is isolated and identified from the ailing fish, a diagnosis of furunculosis cannot be positive.

B. salmonicida is a short, nonspore forming, nonmotile, gram negative rod, which under aerobic conditions produces a water-soluble, diffusible brown pigment, when grown on favorable solid agar media. It produces acid and gas in dextrose, galactose and mannitol but not in lactose and only irregularly in sucrose and maltose. It liquifies gelatin, slowly peptonizes milk and is hemolytic. Since it is the only nonmotile rod which produces soluble brown pigment and is known to be recoverable from the blood or tissues of diseased, but still living (or freshly killed and unspoiled) fish, a presumptive test of much certainty is easily made.

Because sulfamerazine treatment is effective against furunculosis but not necessarily against other diseases, prompt bacteriological diagnosis is important.

At the Leetown Station (P. O. Kearneysville, W. Va.), the presumptive test is carried out in the following manner. Small fish (two inches or less in length) are put directly into the disinfecting solution, consisting of the commercial roccal solution (10%) diluted 1-100 with water, and allowed to remain in the solution 5 to 10 minutes. Larger fish are first killed by a sharp blow on the top of the head and then, like the smaller fish, surface disinfected by immersion in the roccal solution. A fish to be examined is removed from the solution, the roccal removed from a selected area by sponging that area with alcohol, and the alcohol then removed by evaporation. (This provides a sterile area, free from disinfectant.) Material for the inoculation of media usually is removed from the kidney or associated blood vessels or from a closed abscess. The kidney is most readily exposed by making a transverse incision with sterile scissors or scalpel, before or just behind the dorsal fin. This incision must be deep enough to expose the kidney, which lies under the vertebral column, but not deep enough to cut the gut. Some blood and tissue are removed from the kidney and blood vessels, with an inoculating loop, and deposited upon an agar slant or plate and a tube with semisolid medium.

Agar slants or plates are prepared from a medium of the following composition:

Tryptic digest of casein	15 to 20gm
Sodium chloride	5gm
Agar	15gm
Distilled water	1 liter
pH	7.2 to 7.4

For the semisolid medium the agar is reduced to 0.1 to 0.3%. The above formula, so modified, or any standard commercial semisolid medium is satisfactory.

Cultures are incubated at 18 to 20° C. Growth usually is visible within 24 hours and brown pigmentation in the agar slant within two to three days.

If the isolated bacteria produce diffusible brown pigment, and if nonmotility is indicated by the absence of spreading growth through the semisolid medium, the presumptive test for *B. salmonicida* is considered positive.

Treatment

Until a controlled laboratory experiment testing certain sulfonamides and other drugs was run at Leetown, no effective treatment was known and the disease was considered incurable. The only really effective measure was to destroy the fish where furunculosis had appeared, disinfect ponds, and restock with disease-free fish.

In 1946, 1947 and 1948 Gutsell reported that sulfamerazine is effective in the treatment of furunculosis and that a daily dosage rate of eight grams per 100 pounds of fish (or 17.6gm per 100kg) is sufficiently high. In 1946 (Gutsell, 1947; Gutsell and Snieszko, in press) four to six grams per day per 100 pounds of fish were found to be effective. Since then, to be on the safe side, the six-gram rate (six grams per day per 100 pounds of fish, or 13.2 grams per 100 kilograms) has been recommended.

This treatment should be continued for three weeks.

If the weight of fish is not known, the drug should be proportioned to the weight of the food. If the fish are being fed fairly heavily, one gram of the drug per pound of feed is sufficient, but if the fish are being fed quite lightly (maintenance diet or a little more) 1.5 to 2gm per pound should be used.

Since treatment with sulfamerazine does not altogether remove the danger of carriers, a close watch should be kept and treatment resumed if there is any increase in mortality, not due to other known cause or causes. This resumed treatment should be continued for three to four days, unless bacteriological examination, which should be undertaken as soon as the reappearance of furunculosis is suspected, shows that losses are not due to this disease. Therapy for three to four days should be repeated as often as necessary, to keep the disease under control. Complete elimination of the disease from a contaminated lot of trout is not always possible.

The sulfamerazine is administered in the food. Once a day appears to be as effective as more frequent treatment. If it is desirable to feed the fish more often, however, there is no objection, provided that all the food contains the drug and that the daily amount of the drug is correct.

It is important that all fish obtain a suitable amount of the drug. To insure this, insofar as it may be done, the drug must be thoroughly mixed with the food to insure even distribution, and there must be sufficient food for each fish to obtain its share. We recommend that the amount of food at each feeding be about all the fish will take.

To secure a uniform distribution of the drug, it is recommended that the sulfamerazine be mixed with the dry feed and the dry feed mixed thoroughly with the meat. If dry feed is not used, it is recommended that the drug be mixed first with a small portion of the meat and that portion mixed thoroughly with the balance. Of course, the meat should be ground finely enough so that each tiny portion will contain some of the drug.

To insure good cohesion and reduce loss of the drug to a minimum, it is recommended that the meat, or a large portion of it, be spleen (melts) and that the diet include 2% of salt.

Besides the experimental work, sulfamerazine has been used for practical treatment of trout in pools, raceways, and ponds. At our station, as well as in many fish hatcheries over the country, the treatment of furunculosis with sulfamerazine has been found effective and practical and the information on hand seems sufficient to recommend, the practice of treating furunculosis of fish with sulfamerazine, under all conditions.

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There are more than 40,000 species of fish in the world.

It requires more than 100 Philippine goby fish to weigh one ounce. Specimens of the whale shark weighing more than 40,000 pounds have been captured.

There are fishes with divided eyes; the upper part for seeing in the air, the lower for under water vision.

Lung fish can breathe in the air as well as in water. Some scientists consider them to be on the way to evolving into land animals.

Some fish are placid, others are nervous and easily irritated. Some are timid, others fearless; some are lazy, others energetic; some are bloodthirsty, others mild; some hibernate in ice, others in mud, some are poisonous, many are edible. Even some sharks are harmless but most of them are dangerous.

Clinical Reports

Antihistaminic Treatment of Laminitis

To test the efficacy of antihistamines in the treatment of laminitis, as recommended by Chavance (*Vet. Med.* June 1946), cases were selected which showed no noticeable response to the usual treatment adopted in my practice. The histories of three such cases in which the results were spectacular are as follows:

CASE 1.—A six-year-old child's riding pony. The animal, which was in "top heavy" condition, had been treated about six months previously for acute laminitis, with little result. When called in, I found her in great pain and scarcely able to stand. There were marked changes in all four feet—the soles dropped and the walls elongated antero-posteriorly and upturned. The pony stumbled along on her heels. The cause, in my opinion, was dietetic in origin, coupled with too little exercise.

Destruction was considered, but postponed a week to try "anthisan." Intravenous injection of 20cc anthisan, 5%, was followed by restlessness, a little sweating and twitching of the mouth and nostrils as in nausea. The pulse quickened slightly but soon settled. These signs resolved in about half an hour, when she was left resting; 24 hours later she was obviously better but still had to be driven to walk. A further 20cc were given intravenously. On the following day she walked with little difficulty, and was in very little pain; 20cc more anthisan were injected. Next day she cantered away when we went to halter her. Improvement was maintained and a week later the feet were trimmed. This was followed by a little tenderness, which disappeared within 48 hours. No other treatment was given or required. The diet was the same throughout.

CASE 2.—A four-year-old pedigree Guernsey bull. Suddenly developed acute laminitis in all four feet. Together with the usual symptoms of great pain, fever, anorexia and rapid loss of condition, a pustular rash broke out all over the body and legs. He had been tied up all winter and this, together with a change of diet 14 days earlier seemed to be the cause.

My colleague, Mr. A. Crosbie, first attended him, thinned out the soles of the feet, changed the diet and purged with "altan." The animal's condition worsened, and a week later he was given 10cc anthisan, intravenously. There were no noticeable signs of discomfort from the injection, and 24 hours later he was much improved; 20cc were then given with no untoward reaction. Next day all the painful symptoms had disappeared, the temperature was normal and the bull eating well. Forty-eight hours later the owner reported the animal normal, and ready for his work. The rash disappeared in a week without treatment. The feet remained normal in appearance.

A group of horses suffering from laminitis nearly one-half of them in all four feet. Those lying could not be induced to stand long enough to be photographed.

CASE 3.—A year-old pedigreed large white gilt. She was in very fat condition and well advanced in pregnancy. She had acute laminitis, was unable to stand, and had refused food for 48 hours. Her temperature was 104.2°F. and the feces were somewhat harder than normal; 10cc "anthisan" was injected behind the ear. No other treatment was given. Twenty-four hours later the temperature and bowel action were normal and she had drunk a good quantity of thin gruel. The feet were still painful, but she got up on her own, although trembling a great deal when she did so. Another 10cc "anthisan" was injected on each of the following two days, by which time she walked out with no difficulty and was left grazing in the paddock.

In another case of acute laminitis in a mare, with superpurgation following an acute obstructive colic, the results were inconclusive as the mare died six hours after the anthisan was given.

CONCLUSION.—In my opinion, souble antihistaminics have revolutionized the treatment of laminitis.—*Wm. F. Kochan,* M.R.C.V.S. in the *Vet, Rec.* 60:22, p. 257. 1948.

Toxemia-Uremia in Pigs

"Because of the variations manifested by a single disease entity as a result of the complexities of the host-parasite environmental balance, any diagnosis in the field is difficult." Excerpted from the report of the A.V.M.A. committee on Diseases and Ailments of Suckling Pigs. *J.A.V.M.A.* 112, p. 349. (May) 1948.

The listing of the symptoms, lesions, etc., in tables 1 and 2, "Diseases and Ailments of Suckling Pigs," (*J.A.V.M.A.* 112, p. 306. (April) 1948) and comments of the committee membership in the following issue are interesting, helpful, and, no doubt, report accurately the observations of the committee members; yet one is bound to observe widely varied and different disease pictures in the field, which further confuse one in making a diagnosis. From my own observations of toxemia-uremia in the field (about a dozen cases), I have come to some conclusions (subject to change without notice), especially with relation to the differentiation of the toxemia-uremia syndrome that differs markedly from the descriptions given in tables 1 and 2 in the following respects:

Of the cases which I believe to be toxemia-uremia, contrary to Table No. 1 in the committee's report, only one outbreak was in pigs five to seven days of age. All others were older up to eight weeks of age. This, I believe, eliminates confusion with hypoglycemia and other diseases which are said to be in the "three-day" pig disease category. None of the pigs in the cases I have observed vomited, had diarrhea or showed itching of the skin. All were anemic, as shown by the watery condition of the blood, though no check was made on the Tallqvist scale. The course of the disease was from a few hours to 24 hours, not to five days as shown in the tables referred to in the foregoing. The onset is sudden. Many pigs are found dead that have not previously been observed to be ill. Pigs normal in every way apparent to the owners, begin to fail suddenly, the hair coat becomes rough, many become comatose and die, all within from three or four to 24 hours after the first symptoms are manifested. On autopsy, kidneys and sometimes the livers are found to be cloudy and friable.

In Table No. 2, the committee gives the age limits as eight and 30 days. The cases I observed were from eight to 56 days of age. None of these pigs vomited, had diarrhea or showed itching of the skin. All were anemic. In these older pigs as in the younger, the onset is sudden. In many instances the first inkling the owner had of anything wrong with his pigs was finding some dead ones. Again the course of the disease was from a few hours to 24 hours, not seven to 25 days as shown in the table. So far as could be determined from the owners, this is a litter disease, though in some litters one or more pigs may escape an attack and survive, after all the remainder are dead.

To substantiate my contention, the following four cases are taken from my notebook.

Case No. 1.—A litter of eight, nine-day old pigs was apparently normal until the afternoon, when several developed a comatose condition. Two others were running around the pen, squealing, and then burrowing into the bedding. Temperatures were from 98 to 104.5° F. There was a history of some slow gaining shotes on this farm the preceding year and, fearing erysipelas might be present, erysipelas serum was administered. By mid-morning of the next day, six of the pigs had died while two still appeared normal. On autopsy of three of the dead pigs, all showed light colored livers and kidneys. In one the liver was ruptured. The bladders in all three were full of urine; two showing a flaky, milky colored urine. The kidneys of the third pig contained brownish deposits of urates. Forty-two other pigs on the premises three to four weeks of age were apparently in normal health.

Case No. 2.—A farmer bought three sows with litters about 10 days of age. The day previous to my visit, one sow lost her entire litter within 24 hours. By the following day, of a second litter of eight, four pigs had died, two were in coma, the other two had disheveled coats. All had subnormal temperatures. On necropsy of two dead pigs, both revealed only light colored, pulpy kidneys but no visible urates. In one pig the urine was cloudy and the stomachs of both were empty. These were Chester-White pigs and the skin was of a dull pink in color. The last of the three sows which the farmer had purchased had a normal litter of pigs which were thriving well at the time of observation.

Case No. 3.—On this farm there were 28 sows and more than 200, four to seven-week-old pigs. All appeared to be thriving until, two days preceding my observation, one pig was found dead. The next day eight died. On my arrival three more were dead, one in a coma and another in spasms. Temperatures were 97° and 98° F. The pupils were dilated. On autopsy of five carcasses, (three dead, two killed), all showed some dark, straw-colored fluid in both body cavities. It was flocculent in the peri-

toneal cavity. The eyes and subcutaneous tissues were bronze in color. Two of the carcasses showed ecchymotic hemorrhages on the lungs; two showed extensive edematous infiltration around the kidneys; three had large amounts of urates in the kidneys and in the urine which was very dark in color. The kidneys and livers were friable. In the two killed for autopsy, the blood appeared to be of a very light red color.

The owner was advised to wean the remaining pigs in these two litters. A report received June 10th, six weeks later, was that one more pig had died. The disease was confined to two of the 28 litters on the premises. One of the affected litters was Durocs, the other of Spotted Poland China. Both litters were about seven weeks of age. All that died, 15, were the largest pigs on the farm.

Case No. 4.—The first two sows on this farm farrowed 19 pigs. The next seven sows lost all their pigs at about one week of age, except one in each of three litters. They seemed to be stronger pigs. These three were hand fed and appeared to thrive normally for pigs weaned at this early age. The 10th sow to farrow had a litter of five pigs and these were still alive at two weeks of age, but were rough-haired, at the time of observation. Two other litters, five to seven days of age, seemed to be failing fast at this time. Three pigs had died and the remainder seemed half dead. On autopsy of the three carcasses, light colored kidneys and livers were found but no urates. All were anemic.

The owner was advised that all pigs should be given an anemia (iron) tablet, also to wean one litter and hand feed it, and to leave the other litter with the sow. Six weeks later, he reported that all pigs left on the sow died within a very short time. The weaned, hand fed pigs were confined for 10 days and appeared to be thriving. The owner then decided to turn them into a grass lot. All died within two days. I did not autopsy any of these and do not know the cause of death.

I still believe toxemia-uremia is a distinct disease. For the last several years before my co-worker, Dr. John S. Koen, Storm Lake, Iowa, retired, he reported a deadly condition in pigs that he called "toxic milk disease." He reported that at one time when he found one of these cases, he persuaded the owner to place some of the affected pigs on a sow whose pigs appeared to be thriving and these pigs then began to thrive, while pigs taken from the good sow and placed with the failing litter, soon failed also.

Inquiry as to diet of sows, previous to and after farrowing, disclosed it to have been adequate in most cases. In the first few cases that I observed there was no alfalfa included in the diet and I began to wonder if this did not have something to do with these cases. However, in later cases I found alfalfa was included.

A search through various texts to learn the causes of uremia was of little help. They stated, in short, that uremia follows some debilitating disease. Is it possible that some previous debilitating disease in sows, not now apparent, caused them to eliminate excessive amounts of urates through their milk?

By JOE W. GIFFEE, D.V.S.
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Foot-and-Mouth Disease in Chile

I spent quite some time in the dairying districts of Chile on a recent visit to South America especially in the Tamuco area where there are farms milking 300 to 400 cows. I was assured by most reliable and competent agriculturalists that foot-and-mouth had ceased to be the nightmare to them that it used to be. They informed me that Waldmann's vaccine gave an absolute immunity for at least six months and if by any chance they went longer than this before revaccination, spread of the disease, if it appeared, was stopped immediately when the cows were revaccinated.

On one Fundo I saw two heifers with typical foot-and-mouth disease. They escaped when a batch had been rounded up for the semi-annual inoculation. They had been amongst the other cattle and although I stayed on this farm for over ten days, no other cases appeared.

When the immunity is waning and the infection is introduced into the herd, they get cases of malignant foot-and-mouth—no mouth or foot lesions, but general malaise with high temperature and eventually myocarditis.

Foot-and-mouth is very prevalent in Southern Chile in areas where inoculation is not practised regularly and any susceptible animal that is trucked to Santiago for slaughter invariably arrives with the disease.

Further discussion by Mr. Chambers explains that he does not advocate vaccination with the object of living with the disease under the conditions obtaining in Britain, but as a means of facilitating eradication of outbreaks.

While properly trained technicians can and do conduct artificial insemination measures acceptably, the important role of the veterinarian in such matters should not be neglected because of (1) the danger of spreading disease and (2) the necessity of clinical examination of cows for sterility.

Abstracts

Veterinary Vital Statistics and Public Health

Animal health is of direct concern to everyone in the world today.[37] The shortage of food, power, and the disruption of animal disease control measures in the wartorn areas has emphasized this problem. To combat animal disease successfully in the United States it is necessary to have an accurate system of disease reporting to state and national officials. Such reporting is based upon the local veterinarians and the diagnostic laboratories.

It will benefit the public health of the nation by informing livestock disease control officials of potential animal epidemics; thus enabling them to take measures to control or prevent their spread. Such action will prevent animal losses, which would cut down our supply of meat, milk, wool and leather. All these animal products are necessary to protect the nation's health.

Animal disease data would be invaluable to health authorities in taking steps to prevent the spread of certain animal diseases to man. There are over 75 animal disease including parasitisms that are communicable to man. Fortunately the United States is free of many of these diseases. This does not come naturally, but is largely a result of the efforts of national and state veterinary officials preventing many of the worst animal plagues from being introduced into this country and in eradicating or controlling disease, when it has appeared.

Health authorities know it is just as important to have an animal population free of disease as it is to control infectious diseases in man if they are to maintain optimal health for man. The basis of all disease control is knowing the location and the prevalence of disease. This can be known only through a good vital statistical service.

Had the severe outbreak of equine encephalomyelitis that occurred in Lousiana last summer been reported promptly it is very probable some human deaths from the disease might have been prevented.

A system of reporting animal disease should not be restricted to farm animals but should include pets also. Of 100 cases of distemper in dogs that were investigated recently 18 were found to harbor Salmonella infection.

Rapid communication has shrunk the world to the size of the United States in 1910. Veterinarians will need to know a great deal more about tropical diseases than has been thought necessary heretofore. Recently a monkey died of rabies, in Key West, five days after it was landed from an airplane and only 10 days after it had left Brazil.

There are many unsolved problems concerning the animal diseases transmissible to man. There is a type of equine encephalomyelitis in Tennessee that differs from the eastern and western and South American types. The cause, whether virus, bacterium or something else is unknown. "Q" fever, apparently a natural disease of animals, must first be recognized in man.

37 Importance of Animal Disease Morbidity and Mortality Statistics to Public Health, by James H. Steele, D.V.M., M.P.H. Chief, Veterinary Public Health Division, Communicable Disease Center, U. S. Public Health Service, Atlanta, Ga. Proc. 51st. ann. meeting U. S. Livestock Sanitary Assn., Chicago, Ill., Dec. 3, 4 and 5, 1947.

Collection of Animal Morbidity and Mortality Statistics

This was an investigation financed jointly by the Bureau of Animal Industry, USDA, the Iowa Agricultural Experiment Station and Swift and Company, Chicago.[38] It was conducted from April, 1946, to June, 1947, on 177 farms in 20 counties of Iowa. The purpose was to test methods of obtaining veterinary vital statistics, to gain some knowledge as to their cost and accuracy, and to form a rough estimate of the losses from animal morbidity and mortality in Iowa. The plan was to take an inventory of the farm livestock including chickens and turkeys every three months and obtain, from questioning the farmer, information concerning the loss of livestock from disease or other causes, the number of animals ailing and cost of the sickness, and the number of animal births and poultry hatched on the farm, since the last previous interview. In one district a veterinarian was employed to collect these data and he visited each farm once a month.

The cooperation of farmers and their veterinarians with whom the answers as to the cause of diseases and death were checked was excellent in the district.

The major loss among swine occurred from birth to weaning time (20%). The loss among older pigs amounted to 3.5%. The value of the swine lost was placed by the owners at $14,240. This would indicate a loss of $14¼ million for the whole state.

In cattle 9.8% were lost between calving and one month of age. The annual loss among older cattle amounted to 2.2%. The value of the cattle lost by death was placed at $11,376 by the owners, or $11,376,000 for all the state.

38 An Experiment in the Collection of Morbidity and Mortality Data on Farm Animals, by George W. Snedecor, Research Professor and Director Statistical Laboratory, Ames, Iowa. Proc. 51st ann. meeting U. S. Livestock Sanitary Assn., Chicago, Ill., Dec. 3, 4 and 5, 1947.

Book Reviews

Diseases of Poultry, edited by H. E. BIESTER, Professor of Veterinary Research and Director, Veterinary Research Institute, Iowa State College, and L. H. SCHWARTE, Professor of Veterinary Research, Veterinary Research Institute, Iowa State, and 33 collaborators. Second edition, revised and enlarged, buckram binding; 1154 pages; 358 illustrations, including full-page, four-color plates of avian blood cells (new) and of the normal and the diseased ovary. Published by the Iowa State College Press, Ames, Iowa; 1948. Price $10.50.

The first edition of this work was reviewed[1] in some detail. The present edition is by the same group of distinguished authorities on poultry pathology and poultry research. In this, the work has been extensively revised and in all respects it includes advances in the knowledge of the subject that have been developed since the previous printing.

The major changes in this edition include an enlarged chapter on avian pneumoencephalitis, an expanded discussion of poisons and toxins, including recent studies on 1080 (sodium fluoracetate) and a completely rewritten chapter on disease prevention.

"Diseases of Poultry" is a complete reference work on poultry diseases. It contains 40 chapters each including a complete discussion of a definite subject. Being written by research workers it is most adaptable to the needs of those engaged in poultry research. However, the former edition was amazingly well received by practitioners and this one is equally well adapted to the needs of the man interested in the treatment and prevention of the diseases of domestic birds.

Production of Veterinary Books

With the review of a splendid text like the one described in the foregoing commentary, one wonders if it is not a milestone or something, in veterinary literature and if the veterinary profession is not developing stature in its published works. The answer is veterinary literature in this country has been on pretty much of an even keel during the first half of the 20th century, at least. Certainly there has been no bulge in the output of veterinary texts comparable to that in fiction, biography, history, travel, etc., for the general reader.

Recently, an editorial writer stated: "Up to 1939, issue after issue and even whole volumes of leading veterinary periodicals will not yield a book review." He was writing from memory, of course. The record is quite different. An examination of the indices of volumes of this magazine for a score of years or longer is illustrative. The book reviews in 1927 numbered 15; in 1928, 10; in 1930, seven; in 1931, three; in 1932, 13; in 1933, six; in 1934, 13; in 1935, seven; in 1936, 26; in 1937, 30; in 1938, 22; in 1939, 22; in 1940, 25; in 1941, 19; in 1942, 27; in 1943, 26; in 1944, 35; in 1945, 20; in 1946, 21; in 1947, 31, and in 1948 to date, 24.

One hopes the average quality of veterinary literature is improving, but it is not forgettable, that Professor Law's magnificent five-volume work on veterinary medicine was published during the first decade of the century which has not since produced its equal, from a literary viewpoint.

More than 400 veterinary works or works of special interest to veterinarians, is a fair output for a score of years.

1. *Vet. Med.* 38:8, p. 319. (August) 1943.

C. O. Jensen: Selected Papers; Volume I, 1886 to 1908. A commemorative volume; 681 pages. Published by Einar Munksgaard, Norregade 6, Copenhagen, Denmark; 1948. Price not stated.

Carl Oluf Jensen, 1864-1934, was a veterinarian of world-wide reputation in three important fields of science—veterinary medicine, bacteriology and cancer research. He attained distinction also in pathology, biology and teaching.

Doctor Jensen graduated from the Royal Veterinary and Agricultural College of Denmark in 1882. He practiced for a time, suffered a long attack of illness, and in 1889 began lecturing in the Royal Veterinary College, continued teaching in that institution until his death 45 years later. From 1889 to 1908 he occupied several chairs in the College and held a number of important government positions. The volume under review contains 37 papers, 35 written during this period. Fourteen are published in English; 23 in German and French. A second volume will follow containing papers published by Doctor Jensen while at the head of the State Veterinary Serum Laboratory—1909-1933.

The publication of these selected papers was made possible by a grant of the Rask-Orsted Foundation. It seems a fitting way to commemorate the life of one whose contributions had enriched science and scientific literature so greatly.

The articles in the English language include:

Bacteriological investigations of certain milk and butter faults (1891).

Teat disease in the cow (1895).

On the variability of bacteria with respect to their fermentative ability (1897).

Observations on infection with *Bacterium coli* through the alimentary canal in new-born animals (1897).

Different degrees of fermentative ability within the same group of bacteria (1898).

On the invasion of the organism by bacteria as a result of infectious diseases (secondary infection) (1898).

Investigations of the typhoid-colon group, (1900).

On the difficulties of diagnosing the typhoid bacillus and on types of the typhoid bacillus (1901).

Bust of Dr. Carl O. Jensen at the Royal Veterinary and Agricultural College, Copenhagen, Denmark. The men in the illustration are Professor Dr. N. Plum of the College (left) and Dr. J. X. Parent, Foley, Minnesota. The photograph was taken in August 1938.

Some experiments with cancer tumors (1901).

On the occurrence of the erysipelas bacillus on the mucous membranes of healthy pigs (1902).

Investigations on the resistance of tumor cells to intense light (1903).

On the behavior of paratyphoid bacilli (1904).

Protective inoculation against braxy (1907).

Doctor Jensen was well known by reputation in the United States. For a decade and longer after the publication in 1907 of the translation of his Milk Hygiene by Leonard Pearson, it was the adopted text on the subject in most American veterinary colleges. Under the sponsorship of Dr. Hans Jensen (no relative) of Kansas City a fund was subscribed by American veterinarians to erect a bust of Doctor Jensen on the grounds of the Royal Veterinary and Agricultural College in Copenhagen.

Veterinary Clinical Pathology, by EDWARD A. BENBROOK, V.M.D., Professor and Head of the Department of Veterinary Pathology, Iowa State College, and MARGARET W. SLOSS, B. S., D.V.M., M.S., Assistant Professor of Veterinary Pathology, Iowa State College. 187 pages; 217 illustrations. Published by Iowa State College Press, Ames, Iowa. Price, $4.50.

The authors' profound understanding of the subject of which they write and the objective of this work cannot be better revealed than by quotations from the preface. In addition they give valuable information on the subject of parasitisms. The quotations follow:

The control of disease can be successful only when preceded by accurate diagnosis. Parasitism by animal forms is universal among domestic animals. The objective of any parasite is to obtain food, shelter, and a chance to reproduce without imperiling the existence of the essential or the intermediate hosts. This is true parasitism.

Crowding, insanitation, inadequate nutrition, or the breeding of animals of low resistance, encourages parasites to multiply or to attack the host. Thus injury or death will follow. This results in parasitic disease (parasitosis) in a clinically detectable form. Many parasitoses may be diagnosed by the gross routine procedures applicable to disease in general, such as inspection and palpation. Laboratory technics simply increase the accuracy of diagnosis . . . .

The purpose of this publication is to assist in the diagnosis of parasitism and of parasitic disease by means of laboratory technics, and to show by illustrations the more commonly encountered forms, as well as some of those less often seen. . . .

Thus not every parasitic infestation needs treatment — periodic "deworming" without diagnosis is simple quackery. Adequate nutrition, protection from exposure and overwork and sanitary measures that are economically practicable are our chief defenses against parasitosis.

The text is presented in three parts:

1. Fecal examination in the diagnosis of parasitism, including collecting samples and technic of preparation and examination for the eggs and parasitis of the intestinal tract, lungs and in some instances the skin of all domestic animals including birds. The illustrations by which to indentify the eggs or parasites discovered in fecal samples are exceptionally skillfully and painstakingly made.

2. Skin examination for evidence of parasitic mites. Part 2 follows generally the same plan as Part 1.—classifications of mites, collection of skin scrapings and technic of examination.

3. The diagnosis of lice infestations.

An unusually extensive list of references is given—22 pages. It seems doubtful indeed, that the average reader will find use for more than a small percentage of the articles to which reference is made.